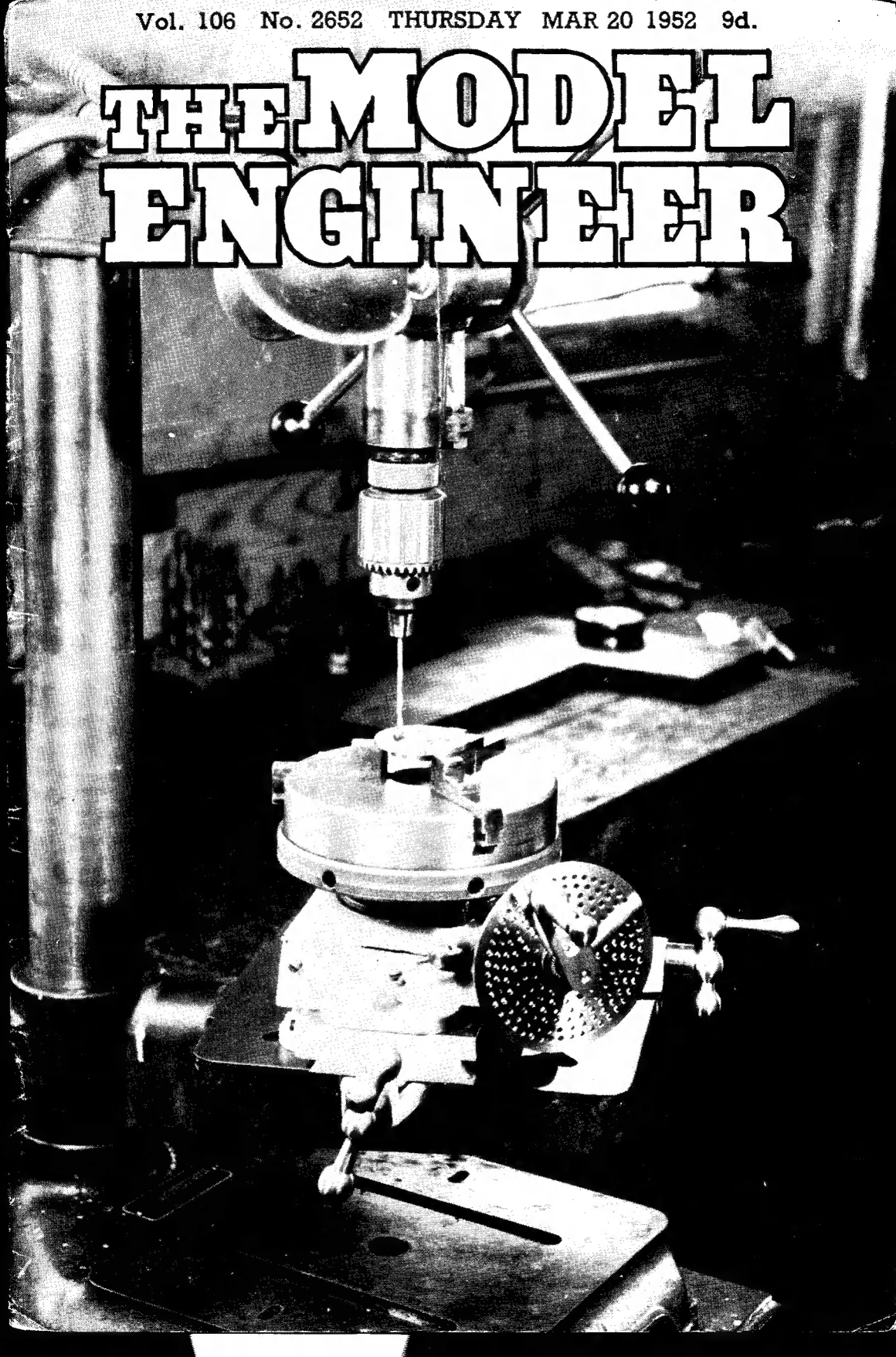
Vol. 106 No. 2652 THURSDAY MAR 20 1952 9d.

THE MODEL ENGINEER



The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

20TH MARCH 1952 VOL. 106 NO. 2652

SMOKE RINGS

Our Cover Picture

● FOR THIS week's illustration we have selected one of five photographs sent to us by Mr. Russell Pickering, of Bryan, Ohio, U.S.A., with a letter which we publish together with the four other photographs elsewhere in this issue. The photograph shows the set-up of a dividing head on a drilling machine, or, as our American friends call it, a drill press, for spacing and drilling the fixing holes in a locomotive cylinder cover.

The "M.E." Always Gets There!

● WE HAVE received a most interesting letter from Mr. R. Abbot who is chief engineer on a motor vessel. He has been a reader for many years, starting as a boy with *The Mechanical Boy*. He has always been intensely interested in model engineering though it is only recently that he has been able to do any serious building, the latest efforts being a *Tich* which has not yet been under steam, and now a *Britannia* is well under way.

Mr. Abbot continues :—"I find 'L.B.S.C.'s' articles pure delight. Three years ago, I built two *Mollyettes* for my children, and was amazed at the power of these little engines. One was to specification, but the other was a 2-4-0 tender engine fitted with link motion ; both are still going strong, although they are getting very rattley now.

"My ambition is to build an exhibition model of the beam engine of a colliery where I worked in 1928 ; it was 90 years old then and has long been scrapped. The bore was 50 in. and the stroke about 120 in., and there was a type of poppet valve operated by what I now realise must have been Watts' radial valve gear. I was only sixteen at the time and have often wished I had known as much about engines then as I do now.

"I trust that you can help me with the back numbers of the 'M.E.' I require to complete my collection which starts from 1942. Nearly all my collection was lost when a ship in which I was serving was sunk by submarine in 1941, and it has taken me a long time to build them up again, especially as I am at sea most of the time. It is surprising where one finds the 'M.E.' I obtained six volumes at a second-hand stall in Hong Kong. In 1947, I obtained it regularly at an Indian bookstall in Singapore ; my 1942-44 issues were in a large parcel of magazines sent to the ship from a Seamen's Mission in New York, and most of the 1944-46 issues were bought from a junior engineer who joined us in England and who also sent to his wife to tell her to deliver the 1946-48 issues to my home while I was on leave ; he was building *Molly*. Since 1948, I have been able to obtain THE MODEL ENGINEER regularly."

This is a most interesting story and very gratifying to us ; it certainly shows that THE MODEL ENGINEER finds its way to unexpected places in the world. We hope that Mr. Abbot will, in due time, realise his ambition by building the model beam engine he mentions, and that we may have the pleasure of describing and illustrating it.

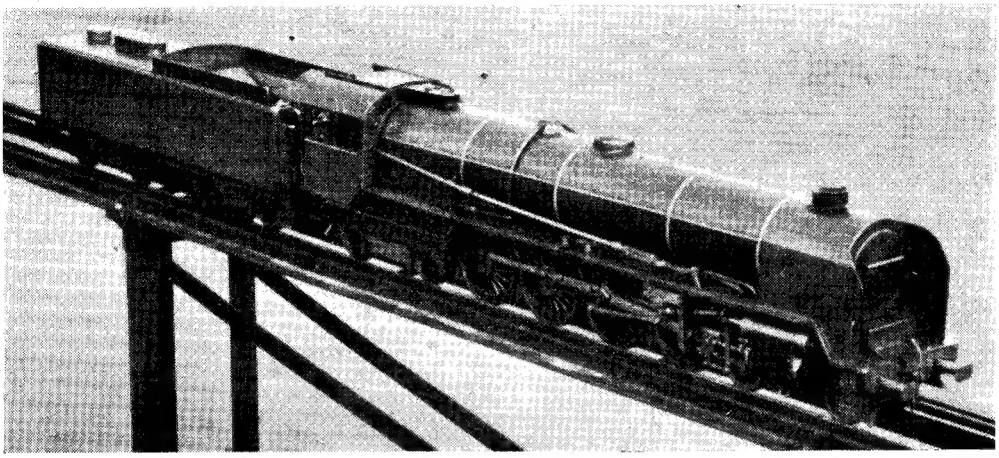
L.C.C. Support

● WE HAVE received an interesting letter from Mr. C. T. Bird, who is the Principal of the London County Council Islington Men's Evening Institute, Robert Blair School, Blundell Street, London, N.7.

A model engineering society has been formed at the Institute and meets regularly every Wednesday and Thursday evening. Projects include model engines, power boats and art metalwork ; but the strongest development has been in passenger-hauling locomotives, several various types of which have been made. One of them, illustrated herewith, was selected for showing at the L.C.C. 1951 Exhibition of London Education, at County Hall. This engine is a fine 4-8-4 type tender engine of free-lance design for 2½-in. gauge, and it is seen standing on a section of portable multi-gauge track the whole of which is now nearing completion. According to another photograph, not reproduced, other engines include : a 2-12-0, a 4-6-2, a 2-6-0 " Dyak " and a 4-4-2 which appears to be twin-sister to the world-renowned *Ayesha*, all for 2½-in. gauge ; a partly-finished " *Hielan' Lassie* for 3½-in. gauge, and a very nice 0-4-0 saddle-tank locomotive for 5-in. gauge. We hope that the builders of these engines can be persuaded to let us have some illustrated descriptions of their handiwork, all of which seems to be excellent.

Mr. Bird writes : " We are fortunate in having a very large roof-playground here, on which we set up our tracks for taking passengers on our demonstration runs. We also have a fully-equipped workshop, the comprehensive fee being 6s. per year."

This seems to us to be an extraordinarily reasonable price to pay for workshop facilities, and we wish every success to the scheme.



Nice Work

● WE HAPPENED to be at Euston station one evening, just recently, and while we were there, the " Royal Scot " train arrived. We watched it come slowly along Platform No. 3, so slowly, in fact, that the driver of the 4-6-2 engine No. 46245, *City of London*, put on steam to ensure that the train drew up at the right spot. We stood fascinated, almost spellbound, as the final application of the brakes brought the train gently to a standstill, *dead on the stroke of* 6 *p.m.* We reflected that this great engine had started her train from Glasgow Central at 10 a.m., exactly eight hours previously (assuming a punctual start), and provided that no out-of-course stops had been made, she had stopped only at Carlisle, to change the crew, on the whole of that 401¼-mile run to London. We do not know what checks, if any, had been experienced on the way, but we thought it a very nice piece of work on the part of the driver to bring the train to its final stop dead on the stroke of right time.

We have no doubt that all the passengers were pleased, to a greater or less extent, that they had arrived punctually ; but we are ready to wager that not a single soul among them gave a passing thought to the supreme judgment whereby the driver and fireman had contrived to reach journey's end exactly to the correct second of time. There are still plenty of engine crews who, if all is well, can achieve this kind of thing every day, but nobody ever seems to thank them for it ! The opinion of the great majority of passengers is : " Well, it's their job."

So it may be ; but it is a job that requires the utmost skill and judgment which deserves the highest praise from all who benefit by it, and an occasional acknowledgment does not come amiss.

These thoughts occurred to us that evening at Euston, as we stood watching about four hundred " Royal Scot " passengers walking off the platform, scarcely one of them so much as glancing at the engine. Stung by what we regarded as their utter callousness, we strolled over to the cab of the engine.

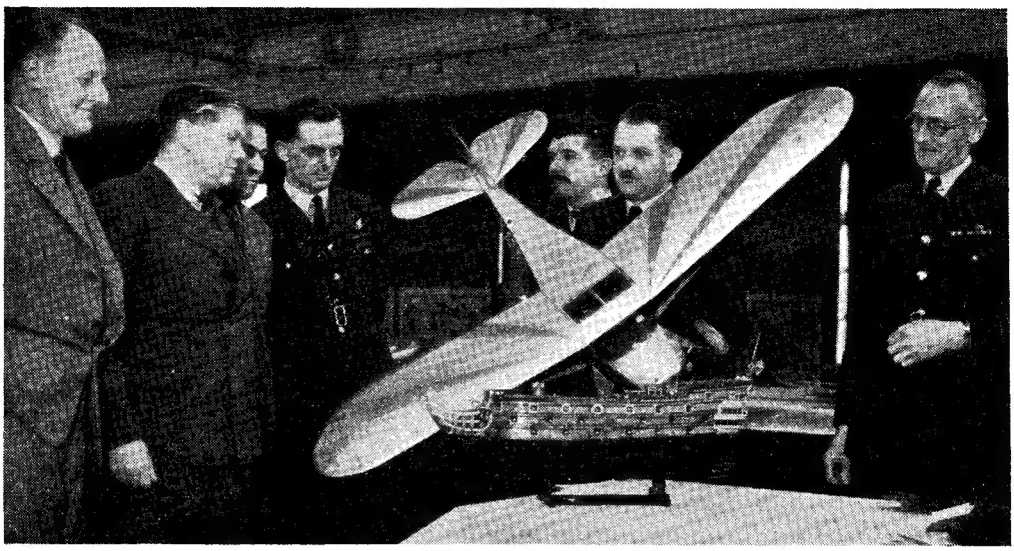
" Good evening, driver," we said ; " that was very good."

" What was ? " he asked.

" Coming in here dead on the stroke of time," we answered.

" It's all in the day's work," he commented.

Yes it, is. Nice work !

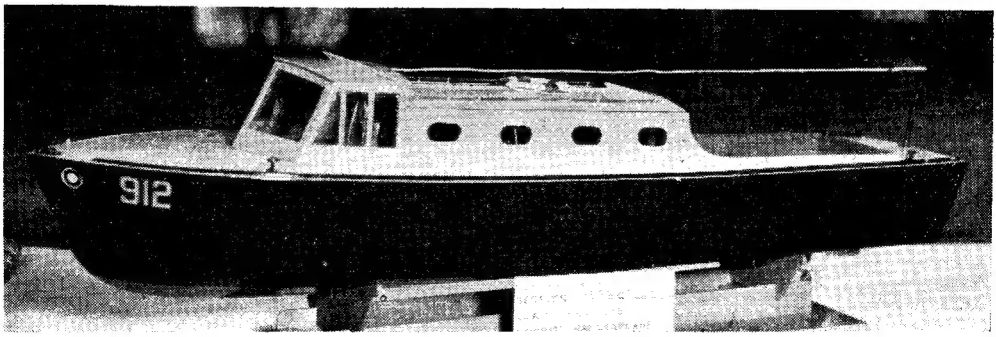


Sqdrn-Ldr. Verney with his radio-controlled Monocoupe, surrounded by a panel of judges

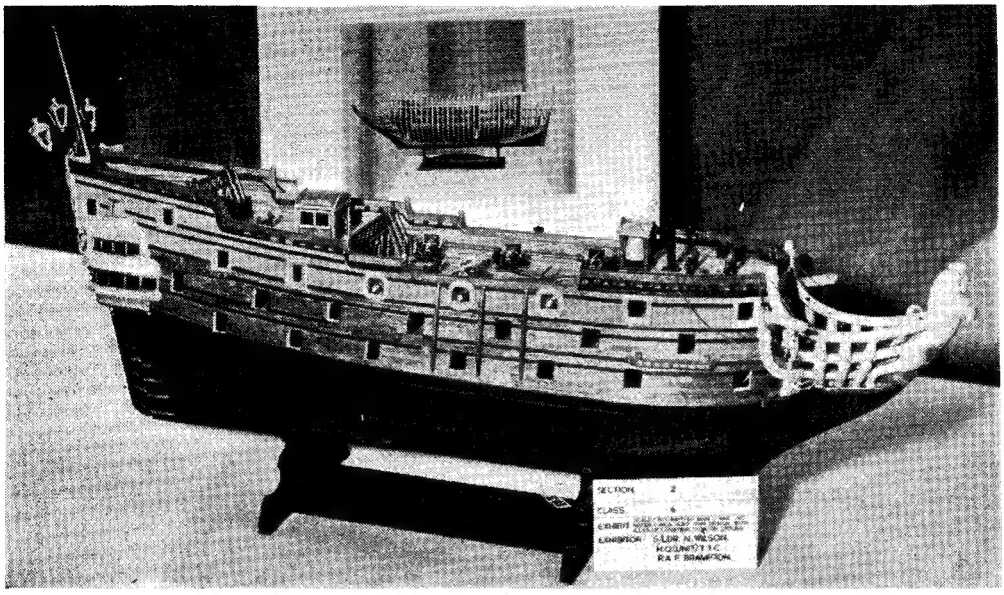
The Royal Air Force (T.T.C.) Models Exhibition

THE first Technical Training Command Model Engineering Exhibition was held recently at the R.A.F. Station, Cardington, Beds., under the presidency of the Air Officer Commanding-in-Chief, Air Marshal Sir John Whitworth Jones, K.C.B., C.B.E. This was intended mainly as a test to ascertain the possibilities of holding a regular, and possibly annual, exhibition of model work executed by officers and other ranks of the R.A.F., and though it was conceived, organised and carried out in the space of less than two months, the results were most encouraging. Over 143 entries were received, and made a very effective display, comprising 4 main sections, namely, Aircraft, Marine, Railway and miscellaneous models, subdivided into ten classes.

The competition was open to all ranks of Technical Training Command, and judging was carried out by a panel composed of officers from various stations of the Command, assisted by Mr. Edgar T. Westbury, of THE MODEL ENGINEER, and Mr. Field, of the Bedford Model Engineering Society. A very high average standard of work was achieved, and some of the models were of quite outstanding quality. Among



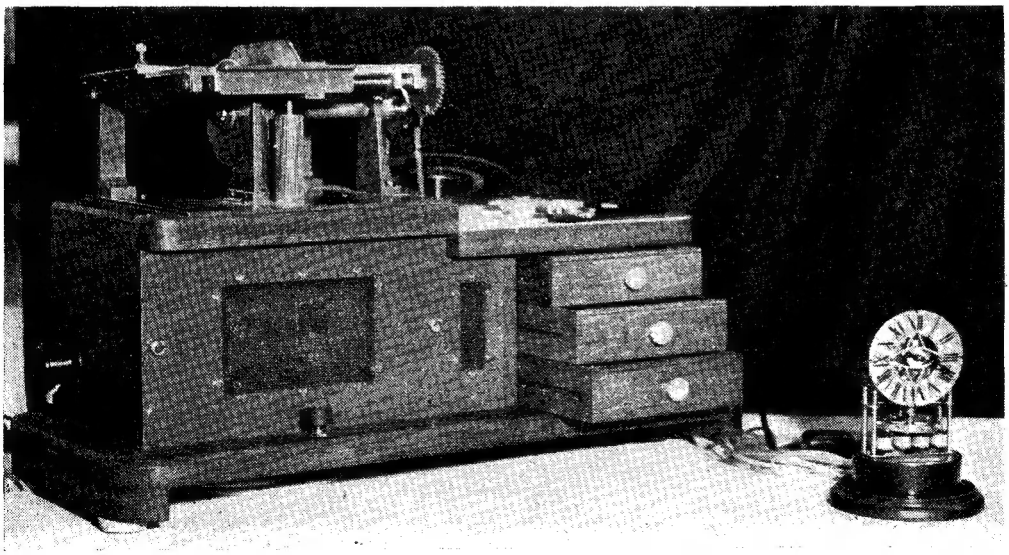
A radio-controlled air-sea rescue launch by Sqdrn-Ldr. Verney



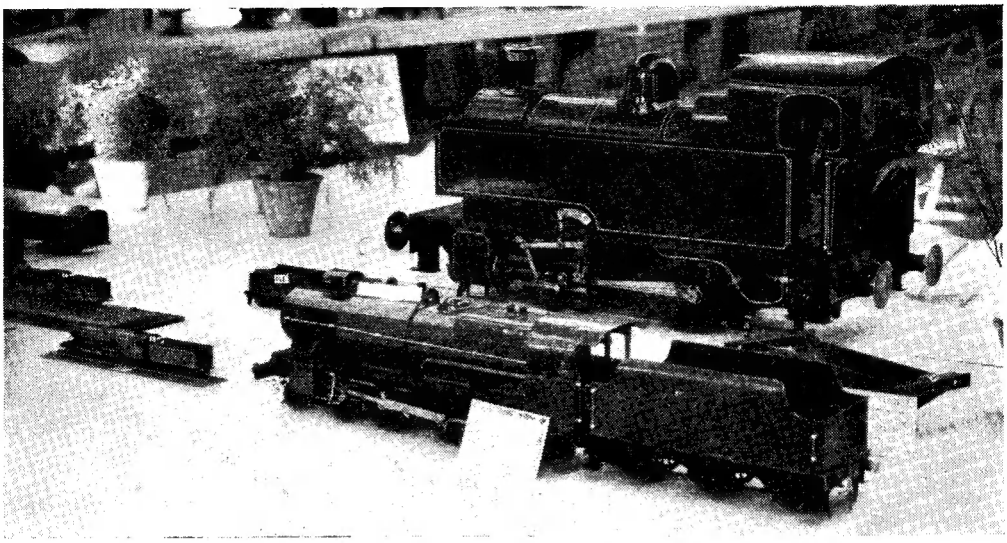
A model of a 17th century British man-o'-war, by Sqdrn-Ldr. Wilson

these may be mentioned the radio-controlled Monocoupe aircraft by Sqdrn.-Ldr. Verney (awarded the prize for the best model in the exhibition) and the radio-controlled air-sea rescue launch (diesel-driven) by the same constructor, also the model of a 17th-century British man-o-war by Sqdrn.-Ldr. Wilson. Some of the exhibits embodied most ingenious adaptations of scrap material and components; these included a practical circular sawing machine with various attachments, built mainly from steel obtained from a Morrison shelter by Flight Sgt. Oxley.

In the Loan section, a remarkable exhibit was a set of three miniature model pistols, constructed by Flt-Lt. K. H. Wallis of R.A.F. Binbrook; these were complete in every detail and capable of firing tiny bullets at high velocity. The

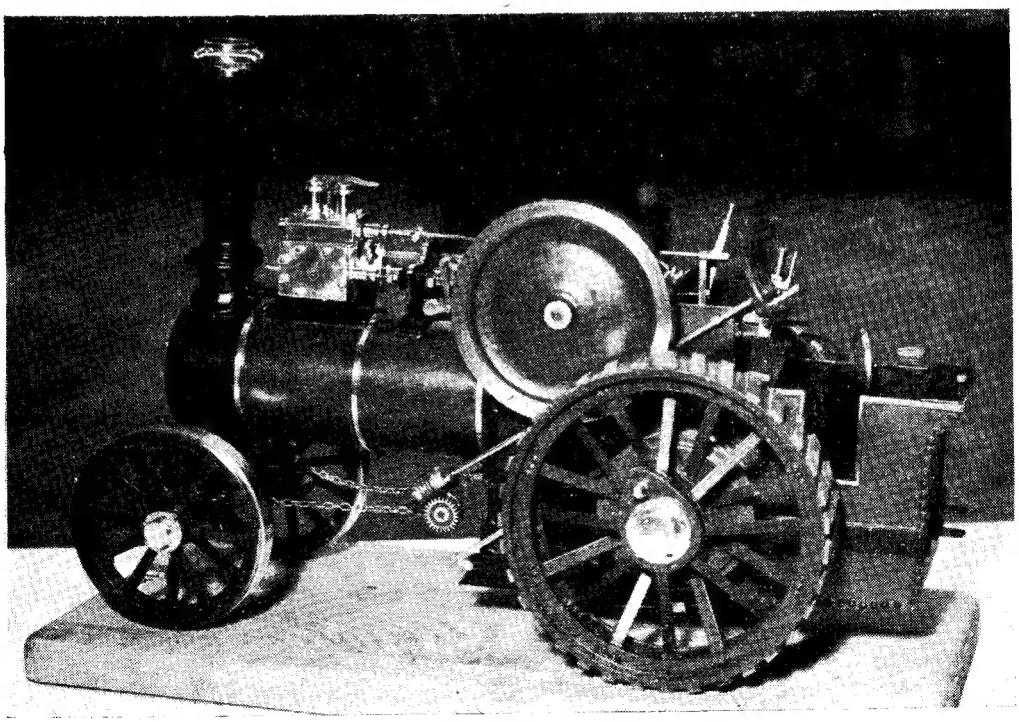


A power-driven circular saw and an electric clock (battery-driven vertical balance type), by Flight-Sgt. Oxley



Some of the locomotive models, including a "Midge" 0-4-0 and a 3½-in. gauge "Olympiade," by Wing-Commander King

Model Railway Club of R.A.F. West Kirby loaned a complete miniature railway layout, and a comprehensive selection of model ships, power boats and locomotives were loaned by the Bedford Model Engineering Society. As an example of the instructional methods employed in the Command for the training of airmen, two mobile class-room displays of the latest types of aircraft engines and equipment were also exhibited.



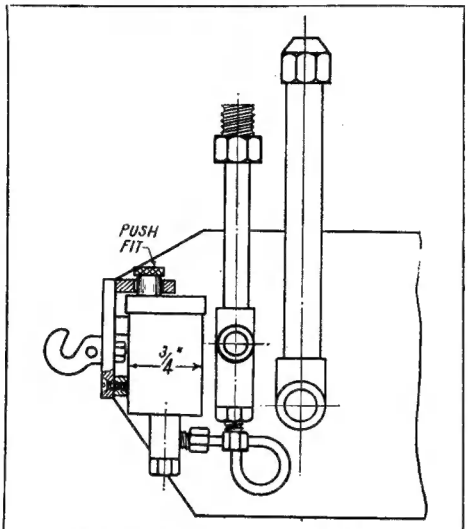
A 1-in. scale traction engine by Group-Captain Eadie

"JULIET" WITH OUTSIDE VALVE GEAR

by "L.B.S.C."

Alteration to Pipework

BEFORE going on to the valve gear, we might as well note the difference in the pipe arrangements for the new cylinders. As far as the exhaust is concerned, there is little to bother about; the simple tee centre-piece, with running joints of the plumbers' pet pattern, is retained, the only difference being, that they screw direct into the holes in the bolting faces of the cylinders, instead of into the holes in the flanges. This necessitates a longer blast-pipe, in order to keep the distance between the blast-nozzle and the bottom of the chimney liner the same as on the original engine. Also, as the cylinders are horizontal, the cross-pipe comes exactly under the centre-line of the chimney; consequently, there is no need for a "set" in the blast-pipe, same being perfectly straight, as shown in the illustration.



How to erect pipes and lubricator

A different arrangement altogether will be needed for the steampipes. In place of the curved pipe, with flanges to attach underneath the steamchests, I have shown a layout similar to that specified for *Tich*, but a little larger, to suit the bigger cylinders. As the construction has already been fully dealt with in the *Tich* notes, a brief resumé here will suffice. Our approved advertisers should be able to supply castings for the crosspiece, or it may be built up by silver-soldering two $\frac{3}{8}$-in. round bosses to a $1\frac{1}{4}$ in. length of $\frac{3}{8}$-in. square brass rod. Round rod would do, but it will be found easier to fit the bosses if square rod is used. Before silver-soldering, chuck the bit of rod truly in four-jaw, face the ends, then centre, drill right through with 7/32-in. drill and tap $\frac{1}{4}$ in. × 40. Drill a $\frac{3}{16}$ in. hole right across the middle. Chuck a bit of $\frac{3}{8}$-in. round rod in three-jaw, face the end, and turn a $\frac{3}{16}$ in. pip on the end about $\frac{1}{16}$ in. long. Part off at $\frac{1}{2}$ in. from the end. Ditto repeato pip-turning, and part off at $\frac{3}{16}$ in. from the end. Squeeze the pips (sounds like making lemon-squash) into the holes in the crosspiece, and silver-solder them; then chuck by the $\frac{3}{16}$-in. bit, centre the $\frac{1}{2}$-in. end, and drill into the passageway with $\frac{1}{16}$-in. or No. 53 drill. Open out to $\frac{7}{16}$ in. depth with $\frac{3}{16}$-in. drill, and tap 7/32 in. × 40. Reverse in chuck, centre the other end, and drill into the passageway with 7/32-in. drill; tap $\frac{1}{4}$ in. × 40, and then run the tap through the long hole, to clean out any burring.

A cast cross-piece will have round side members, so the whole lot can be machined in the three-jaw. Chuck by one end, and drill and tap the long hole first, facing the end truly. A cut can be taken over the outside, to true it up; and if this is gripped in the chuck when reversing, the other end can be truly faced, and the outside skimmed up, for appearance sake, or in case Inspector Meticulous goes down the pit with a torchlamp. Top and bottom bosses are machined as above.

The cross-pipes are two pieces of $\frac{1}{4}$-in. copper tube not thinner than 20-gauge, or they won't take a thread. Each has $\frac{1}{8}$ in full of $\frac{1}{4}$ in. × 40 thread, on one end, and $\frac{3}{4}$ in. on the other. A blank nut is silver-soldered on each, as shown, and a $\frac{1}{4}$ in. × 40 lock nut run on the threads. When the latter is screwed to the end of the thread, and the two pipes screwed right home in the cross, the assembly can be wangled into position, and the pipes screwed out of the cross into the holes in the steamchests, the locknuts being run back against the cross. Don't forget to anoint the threads with plumbers' jointing, or a mixture of red lead and goldsize. The vertical fitting is a $1\frac{7}{8}$ in. length of $\frac{1}{4}$-in. copper tube with a $\frac{3}{8}$-in. × 26 union screw, made from $\frac{7}{16}$-in. hexagon rod, silver-soldered to one end. The other is threaded $\frac{1}{4}$ in. × 40 for about $\frac{3}{16}$ in. length, and screwed into the stub boss on top of the cross. The check valve is made in exactly the same way as the bottom or suction valve of the eccentric-driven pump, but to the dimensions given; a light spring of hard brass or bronze wire keeps the ball on its seat when there is no steam pressure. It also ensures quick closing, as a

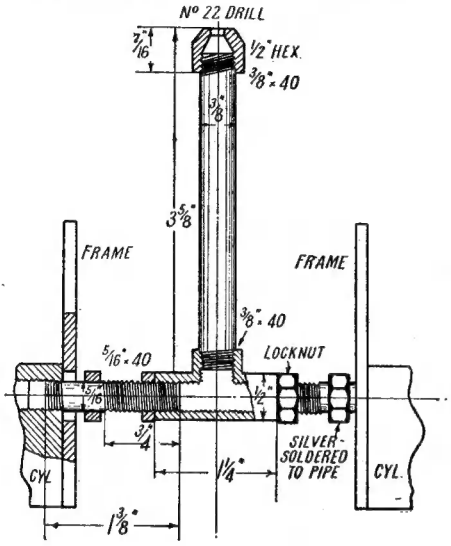
$\frac{1}{8}$-in. ball has a tendency to float in the heavy superheater-grade cylinder oil.

Mechanical Lubricator

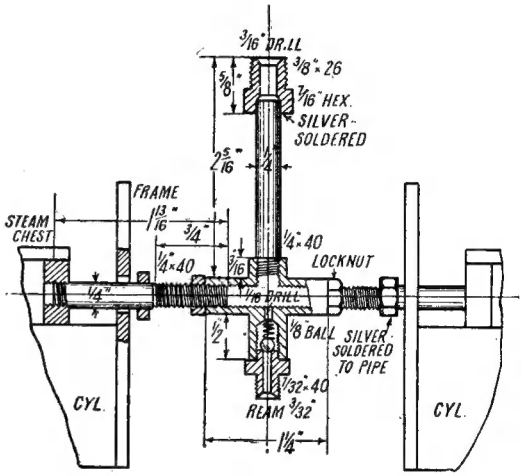
Instead of the displacement or hydrostatic lubricator specified for the original job, it would be an advantage to fit a mechanical lubricator ; and this can be exactly the same as fully described for *Tich*, except for the size of the oil tank, which should be only $\frac{3}{4}$ in. wide, as shown. Otherwise, it won't fit in between the buffer beam and the steampipe assembly. All the rest—pump, eccentric, check-valve, etc., are the same as on *Tich*. The attachment to the buffer-beam is made by two bits of $\frac{1}{8}$ in. $\times$ $\frac{1}{4}$ in. brass rod screwed and soldered to the front of the oil tank, to prop it out clear of the nut securing the draw-hook ; and a couple of 3/32-in. or 7-B.A. countersunk screws, running through clearing holes in the buffer-beam, into tapped holes in the bits of rod (see illustration) will hold it in place, and prevent any attacks of "wobilitis." The filler in the lid is same as *Tich's*, just a bit of $\frac{1}{4}$-in. thin tube, with a turned push-in plug cap ; but it goes through a $\frac{1}{4}$-in. clearing hole in the top of the buffer beam, so as to be easy to get at when filling. Tip : first drill the hole in the beam, then erect the lubricator, and poke a scriber down the hole, scratching a little circle on the lid ; and you'll then have the exact spot on which to fit the filler pipe. The eccentric for driving the lubricator is mounted on the leading axle, close to the axlebox ; this, and details of the ratchet gear, can be obtained from the *Tich* notes or blueprints.

Crosshead with Drop Arm

I said that the guide-bars, crossheads, and connecting-rods were the same as on the original engine, which in fact they are ; but there is a slight addition to make to the crosshead, the rear ends of the guide-bars are fixed in a little different way, and the connecting-rod is a wee bit longer, so please note the following. To prevent anybody "falling out of the cart," I have included a drawing of the amended crosshead complete with drop arm. The actual machining of the crossheads, from a piece of mild-steel of $1\frac{1}{8}$ in. $\times$ $\frac{3}{8}$ in. section, and about $2\frac{5}{8}$ in. long, was described in the notes on the original engine ; same applies to the revised version, but the grooves need milling $\frac{1}{16}$ in. deeper, as the guide bars are only $\frac{7}{8}$ in. apart instead of 1 in. That shouldn't worry anybody !



Exhaust pipes



Steam pipes and oil check-valve

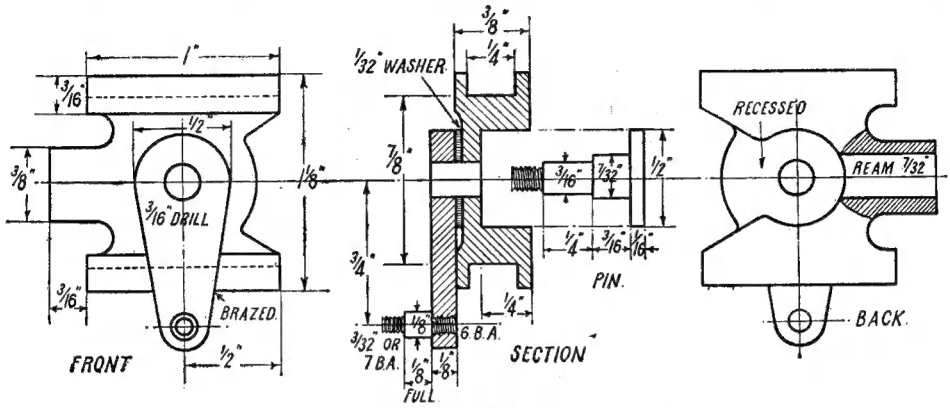
The drop arm is cut from a piece of $\frac{1}{2}$ in. $\times$ $\frac{1}{8}$ in. mild-steel ; or a scrap of the stuff used for frames comes in handy. I save all my frame cuttings, as half of my ancestry hailed from the north side of the border ; and the awfu' price things are noo, it juist disna do tae waste ony-thing, ye ken ! The hole in the larger end is drilled $\frac{3}{16}$; and in the smaller, use No. 44 drill, and tap 6 B.A. The best way I know, of holding the drop arm to the crosshead whilst brazing it in place, is by a hollow rivet. Chuck a bit of $\frac{1}{4}$-in. round steel in the three-jaw ; face, centre, and drill $\frac{1}{8}$ in. or No. 30 for about $\frac{3}{8}$ in. depth. Turn $\frac{5}{16}$ in. of the outside, to a tight fit in the holes in crosshead and drop arm, and part off at $\frac{5}{16}$ in. from the end. Assemble as shown, putting a 1/32-in. steel washer between the drop arm and the crosshead, to pack out the arm, as the crosshead is recessed. Be careful to have the arm at right-angles to the crosshead, as shown. Drive the bit of drilled steel through the lot, and slightly bell the ends with a centre-punch. This will hold the lot together, quite rigidly. Now braze in the usual way ; apply wet flux, heat to bright red, and touch with a bit of soft brass wire. Quench in water only. Scrape off any burnt flux, then put a $\frac{3}{16}$-in. drill through the full combined thickness of crosshead, washer,

and drop arm. This will clean out the hollow rivet completely, and leave a $\frac{3}{16}$-in. hole in the right place for the crosshead pin. Judicious application of a file and emery-cloth will soon restore the pristine beauty of the crosshead.

The little crankpin is turned from $\frac{1}{8}$-in. round silver-steel held in three-jaw, the part that screws into the drop arm being turned 7/64 in. and screwed 6 B.A. Let it project slightly, and rivet over the end. The outer end is screwed 3/32 in. or 7 B.A. to take the retaining nut holding the union link in place

too; the engine went the opposite way to the lever, so it was evident that I had made some error in the valve-gear!

Oh, dear—"where ignorance is bliss"—you know the rest! The fatal mistake was *just the one alteration that he had made*—substituting outside-admission slide-valves for inside-admission piston-valves. The valve-gear of *Doris*, which is a close approximation to the gear on the full-sized L.M.S. class "5" "Black Staniers," plus "a little bit of something that the big ones haven't got," was arranged to suit



Crosshead and drop arm

The crosshead pin is turned from $\frac{1}{2}$-in. round mild-steel to the given dimensions. The only difference in the connecting-rods is that they are $6\frac{1}{4}$ in. between centres, instead of the $6\frac{1}{16}$ in. measurement given for the original engine. Next stage will be the outside valve-gear.

Alterations in Other Designs

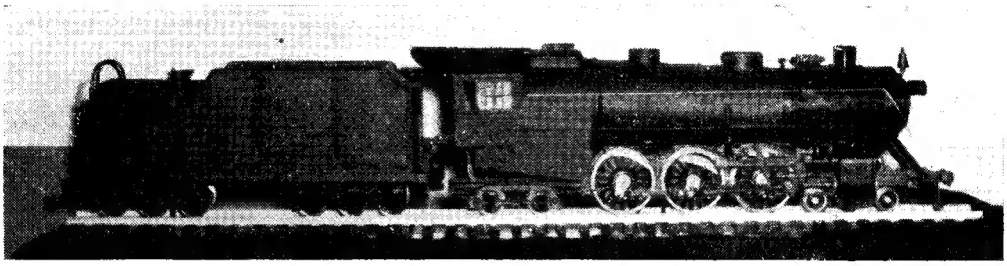
Whilst on the subject of building a locomotive with certain alterations as compared with the original specification, it is all right in a case such as we are now dealing with; the substitution of an outside valve-gear, with cylinders and other components to match, is quite in order. There are, however, plenty of cases where it is absolutely fatal to make any alteration; and my correspondence has revealed several instances where a builder, either acting "on his own," or by listening to the views of our old acquaintance, Mr. I. Knowitall, has made alterations which have robbed the engine of all its efficiency. For example, a builder said that a *Doris*, on which he had spent much time and money, had turned out a complete failure. It would run, but had no speed or liveliness, and the boiler would not maintain steam. Mr. I.K. blamed the design, said the boiler was no good, and advised the builder to add a pony truck, and provide a wide-firebox boiler, which would make the necessary steam. The engine was built according to my instructions, but Mr. I.K. had told the builder that it was impossible to make small piston-valve cylinders with steam-tight valves, so he had substituted slide-valves. That was the *only* alteration, and he didn't see that it would make any difference. There was another peculiarity, the inside-admission piston-valve cylinders specified for *Doris, and no other kind*. Proof that it *does* suit, can be found in the scores of these engines successfully running about in all parts of the world; several have been illustrated in these notes. The first thing that happened to the failure, was that the ports and valves on the substituted slide-valve cylinders didn't correspond to the ports and valves on the specified piston-valve cylinders. The second thing was, that the connections at the top of the combination lever retarded the movement of the valve instead of advancing it, as an outside-admission slide-valve moves in the opposite direction, in relation to the piston, than does a piston-valve with inside admission. Thirdly, with the return cranks following the main cranks, the die-blocks had to be at the *top* of the links, to go ahead; this was the cause of the engine running the opposite way to the lever. The late admission, and incorrect valve events, mopped up twice the amount of steam normally required, and back pressure further retarded the movement of the pistons; hence the poor performance, and the failure of the boiler to produce the steam to be wasted.

I told my correspondent to scrap the cylinders, and make a new pair of piston-valve cylinders exactly to specification, as I had neither the time nor the inclination to redesign the valve-gear, to suit the cylinders he had fitted, and supply him with the information and drawing by post direct. He is now on the job; a sadder, wiser, and poorer man. Maybe I was a bit curt and brusque; but to be quite frank and candid,

(*Continued on page* 369)

MORE AMERICAN APPRECIATION

A new reader in the U.S.A. loses no time in getting into touch with us

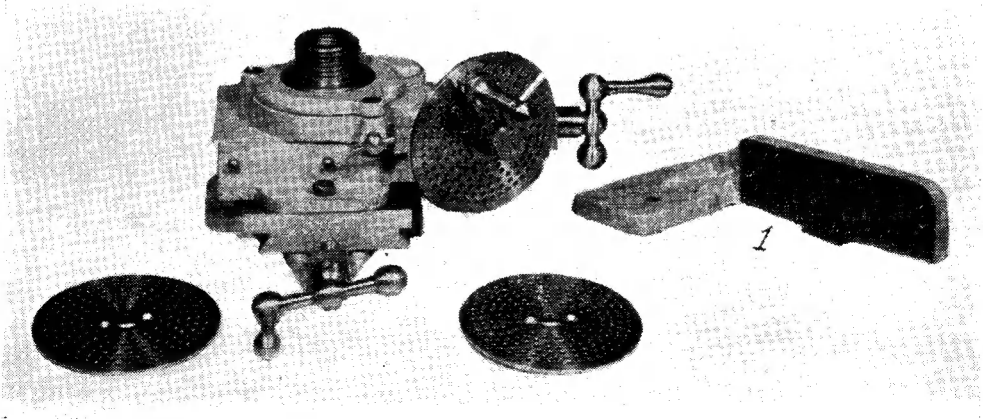


A father and son's result at small locomotive building

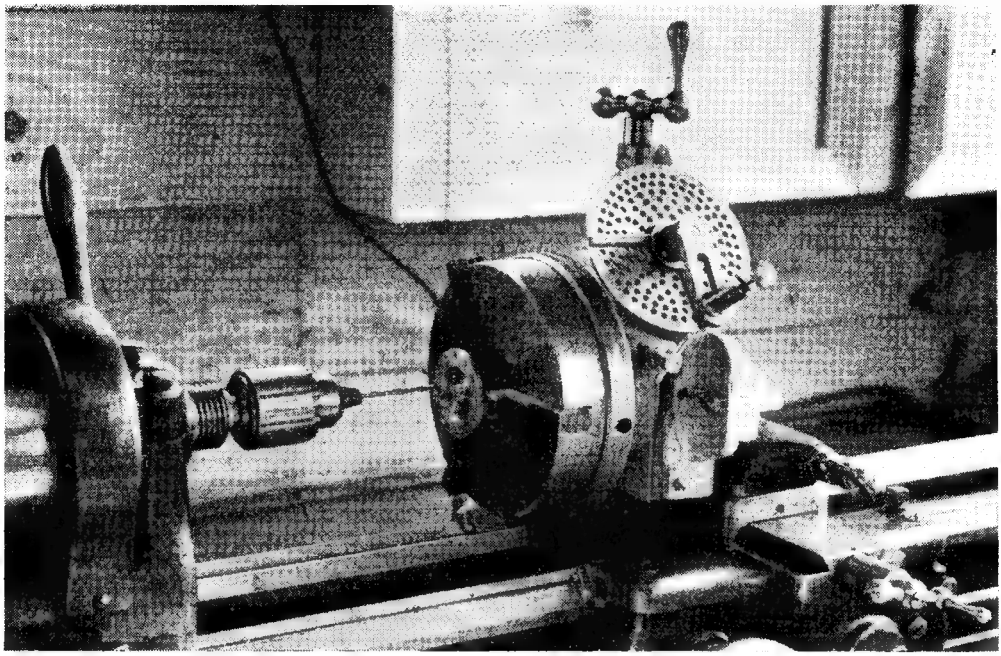
WE have lately received the following letter and photographs from Mr. Russell Pickering, of Bryan, Ohio, U.S.A., and we are publishing them, not only because of the very gratifying appreciation expressed, but also because of the very human story and the first-class practical work they reveal. Writing under date February 14th, 1952, Mr. Pickering says :—

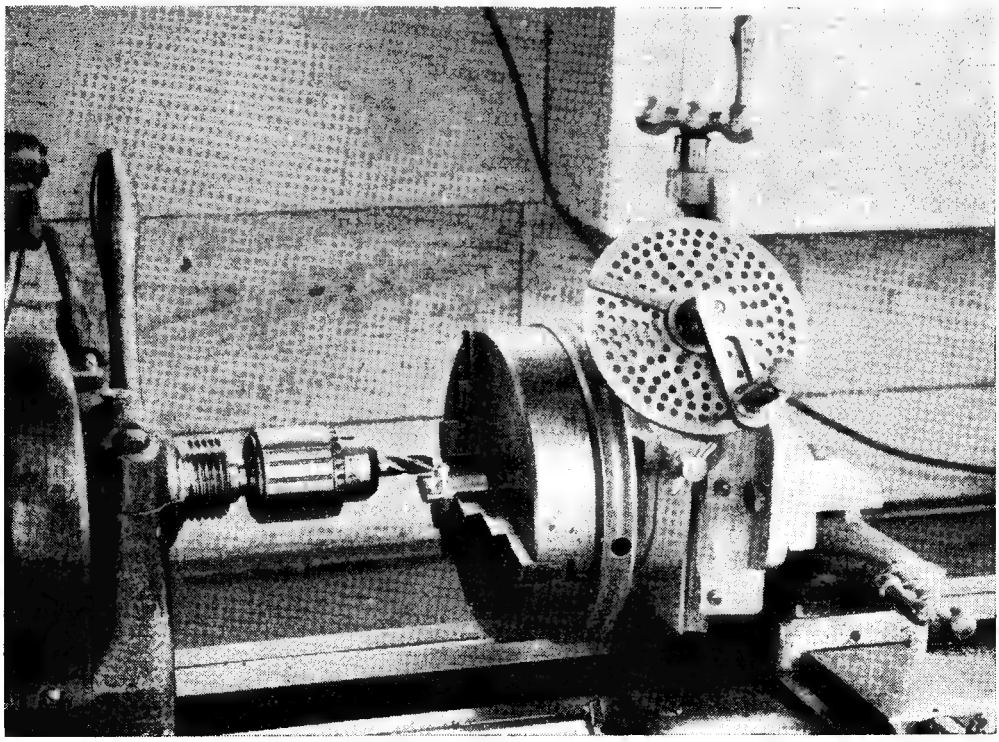
"We have received our first two copies of THE MODEL ENGINEER, and I must say we are greatly pleased with their contents. I can plainly see now where we have missed a great deal of good reading on a subject that we have been greatly interested in for a number of years, by not having learned about your grand magazine a long time ago. The son and I have a very complete small-power tool machine shop at our home where we have spent a good many happy hours designing and building accessories for our machine tools ; also, steam and gasoline engines that we are able to get plans and castings for. Speaking about myself you will notice by the magazine *Ambition* (a copy of which was enclosed, printed in 1935) that I am a machinist and always been interested in prime movers of all kinds.

"My father was born and raised in Birmingham, England, where he learned the machinist trade and worked in a machine shop there until about 1880, when he came to this country and lived with his uncle and aunt on a farm until they passed away ; then moved to Defiance, Ohio, and worked in a large machine shop and was followed by each of his five sons who served our four years' apprenticeship in the same shop. Father passed away in 1912, while I was still in school, a boy of 14 years ; this was a great loss for me, as dad and I were always close pals



Photograph "A." The dividing head and toolpost clamping bracket





Photograph (above) "B," and (below) "C"

whenever he was around home. I think I can claim this as a heredity, and the reason why my son and I have always been such close pals and get along together in our own little shop without ever an argument, always ready to help each other in anything we are doing.

" The son is 27 years old now, and is attending an engineering college about 35 miles from our home, whereby he gets home on weekends, when we are always together in our shop. He is taking Mechanical Engineering and will graduate during this coming summer. He saw 34 months' service in the U.S. Navy, where he had four months' training on the various types of internal combustion engines such as used on small ships and boats, his actual services being in the south-west Pacific, and on the western coast of the United States. He made many good friends while in the Navy, and one of them made us a present of quite an assortment of rough castings for a locomotive that we have been working on in our spare time during the last two and a half years, a picture of which is enclosed, but was taken while it was on display in a local hobby show and before it was as nearly complete.

" Your article in the January 10th issue, page 43, describes a universal dividing head by A. R. Turpin. The four photographs show the second dividing head built by ourselves in our own shop. Photograph A shows the complete head, 1 being the bracket as used to clamp it on the toolpost rest as in photographs B and C. Photograph B shows its use while equally spacing and drilling the bolt holes in the locomotive cylinder-heads on the correct drill circle. C shows how we milled the diamond shapes on our piston-rod packing glands in the lathe. D (on the cover) shows the same operation as II being done in the drill press. You can see that the spindle nose is turned and threaded so either one of our chucks or faceplates will screw on to it, making it adaptable to many different operations. We also have a conventional type dividing head which is used on our milling machine, and was also built in our shop.

" Also, in the January 10th issue, page 55, there is an article explaining the construction of a twist drill grinding jig, being a continued article from the December 27th, 1951 issue. We are badly in need of a jig of this kind and will soon start this project. We have never seen what we considered a good drill-grinding fixture for the smaller drills, and have discarded dull drills due to the difficulty in correctly grinding them free-hand. We are also interested in drawings and plans for the " Busy Bee " engine which is the subject of the letter written by Mr. J. F. Hickie.

" L.B.S.C."

(*Continued from page* 366)

I'm about sick and tired of hearing tales of failures caused by no fault in my designs or instructions, but merely by builders making alterations to suit their own or somebody else's fancies.

Per Contra

Thank goodness there is another side to the picture, which pleases your humble servant very much. Castings and parts are still sold for locomotives designed when the Antediluvian Association of No Leaders and Small Porters was in its heyday; and beginners without experience are misled by the specifications, purchase castings and material, and hopefully get cracking. Then either somebody who has built a " redhot " live steamer, puts them wise, or they suddenly tumble to the fact that the job they are building is a vastly different proposition to the kind of thing described in these notes; they begin to " hae their doots," and the result is that I receive a harrowing tale of woe. If the work hasn't progressed too far, my usual advice is to pitch the whole lot in the domestic ash-bin, and make a fresh start—and the advice is usually taken ! ! If the engine is well on the way, I tell them what parts to scrap, and what components of engines described in these notes can be used on their own job, to ensure its being a success. That advice is invariably followed, too, and the resulting locomotive comes up to expectations.

I frequently receive a letter intimating that the writer of same wishes to build some type of engine which he particularly fancies, maybe for sentimental or other reasons, but which hasn't been described in these notes. He wants to combine the correct outside appearance with the highest possible working efficiency; could I therefore recommend a boiler, cylinders, and motion, which *has* been described, and which could be adapted to the suggested engine. In cases of this kind, it is usually easy to make a recommendation, and the job turns out a winner. There are scores, probably hundreds, of little locomotives running around, which have never been described and illustrated in my " serial stories," but whose " innards " conform to the principles laid down, in every way; and in that connection, maybe " a word to the wise " wouldn't come amiss. Messrs. Percival Marshall & Co. Ltd. have now taken over the production of sets of blueprints for " L.B.S.C." engines; the *Maisie* and *Tich* " A to Z " fully-detailed instruction books will soon be available; and with the *Live Steam* book for assistance with components, there will be ample " guaranteed " information available to everybody who wishes to build an efficient, hard-working, and satisfactory locomotive of *any* type. The principles of all steam locomotives are the same; construction methods vary but little; and when you know one, you know the lot !

PETROL ENGINE TOPICS

*"New Engines for Old!"

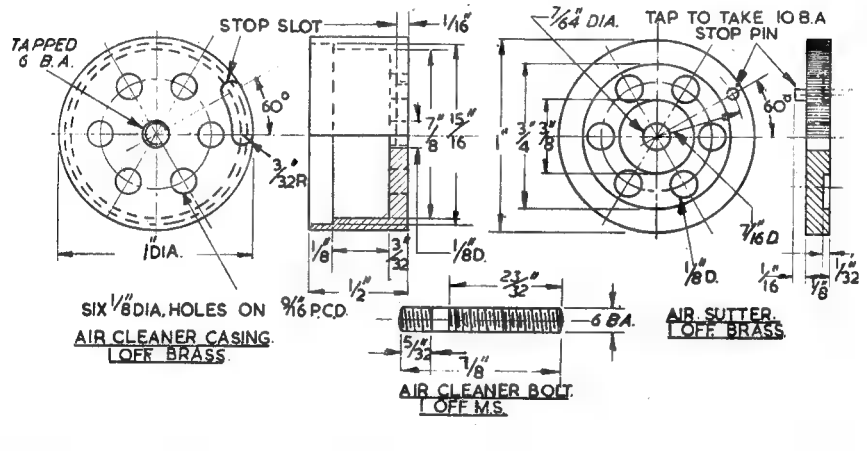
How an Ancient Gas Engine was Improved, Modernised, and Given a New Lease of Life

by Edgar T. Westbury

THE adjusting thimble for the carburettor jet control was turned from brass bar, and was centrally drilled $\frac{1}{16}$ in. diameter right through, then opened out No. 32 and tapped 4 B.A. for a depth of $\frac{1}{2}$ in. It is important that these holes are concentrically true with each other. Before parting off, the outside was shouldered down, and the edge knurled. The jet needle was made from a piece of silver-steel rod, the pointed end being formed by filing, in an improvised filing rest made from a piece of hardwood held in the toolpost. A groove was formed in the top surface of the wood in which the end of the rod, extended about 1 in. from the chuck, was supported. For rough forming, a smooth file was used, both the wood and the steel being filed away to the required angle; a fine pivot file was then applied and finally an oilstone slip to take out all file marks. Stainless-steel would have been preferable for this needle, had it been available, as ordinary petrol (not mixed with oil, as for two-stroke engines) is sometimes found to have a corroding effect on steel.

The thimble was screwed on the jet tube as far ■ it would go, and the needle pushed right home in the jet orifice, cut off flush with the top of the thimble and soldered in, using ■ blowpipe to ensure proper penetration of the solder. After cleaning up the top surface of the thimble, it was marked with 12 radial divisions, using ■ point tool on its side, in conjunction with indexing of the mandrel by means of a 60-tooth change wheel, and ■ "zero point" plainly marked on one of the lines.

A piece of semi-hard spring steel was used for the click spring, and this required no heat treatment after forming to shape. If a piece of clock mainspring is used for this purpose, it would need to be annealed before bending and afterwards rehardened and tempered; not at all an easy job with such ■ small spring.

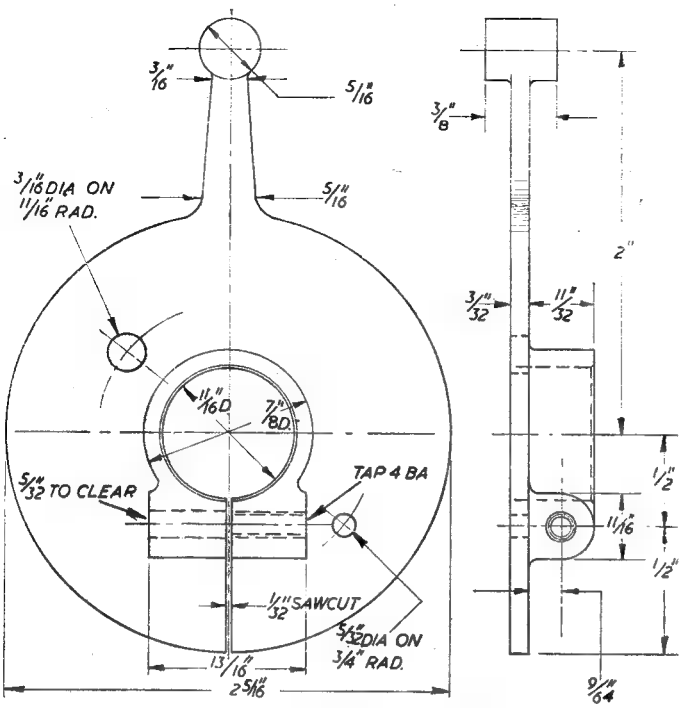


Air Cleaner

The air cleaner casing is turned from brass, and made to press over the intake flange. It has six $\frac{1}{8}$ in. holes in the end, registering with similar holes in the disc forming the air shutter, and is centrally drilled and tapped 6 B.A. for the pivot stud, which is screwed tightly in from outside. The length of thread is arranged so that when the shutter is assembled, with the double-turn spring washer in place, the nut can be screwed home, allowing the shutter disc to move friction-tight. In order to limit the movement of the shutter, ■ pin is screwed into the back face, near the outer edge, and ■ recess is end-milled in the edge of the casing to clear the pin, and allow it to move over an angle of 60 deg.

On the inside of the casing, the pivot stud projects and is used to hold the air cleaner in

*Continued from page 313, "M.E.," March 6, 1952.



CONTACT-BREAKER HOUSING
1 OFF L. ALLOY

position. The two discs of gauze have holes punched in the centre with an eyelet punch, and the steel wool is formed into an annular grommet which is held lightly between them. A 6-B.A. Simmonds (self-locking) nut is fitted to retain, but not compress, the filter; alternatively, a short distance tube could be fitted over the stud so that an ordinary nut could be used, screwed up firmly to clamp the gauze discs but leaving the steel wool free.

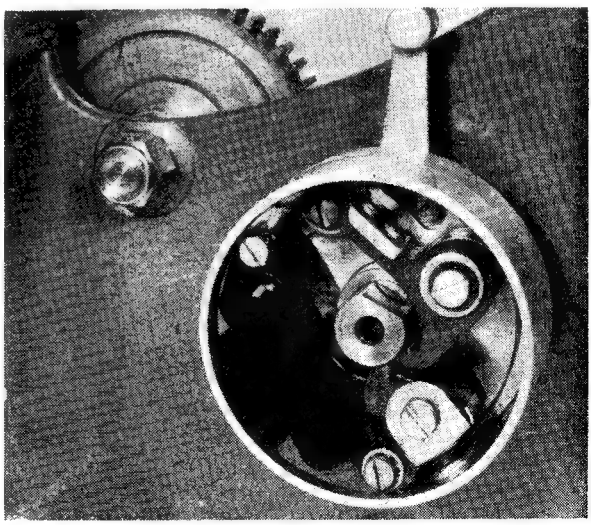
The entire air cleaner assembly is made to press over the intake flange of the carburettor and retained by spinning over the edge of the casing.

Contact-breaker

It has already been mentioned that this component was adapted from one taken from an old Wico Series A magneto, a type of magneto which is very commonly used on industrial engines, such as those employed in the Services for driving portable generators, and the components for them may sometimes be obtained cheaply on the surplus market. As the particular type of magneto is of the rotary-magnet type, the contact-breaker is essentially similar to that used for coil ignition, and can readily be adapted for that purpose; in the older rotary-armature type of magneto, the contact-breaker revolves bodily, and is operated by an internal cam, so that it would be more difficult to adapt, though not impossible, if a modified form of backplate is employed. It may, however, be found easier to obtain the components of an old motor-car distributor head, the low-tension end of which, if in good condition, can be used with little or no alteration.

I have often recommended using components of standard automobile ignition equipment in building contact-breakers for small engines; the usual objection to using a more or less complete assembly, however, is its size, which would be out of proportion to that of the engine in most cases. Such an objection, however, does not apply in an engine of this type, in which there is no difficulty in accommodating a large contact-breaker, and its robust proportions are a practical asset. With the arrangement of the camshaft described, the breaker can be located in an unobtrusive yet readily accessible position, being hardly visible when the engine is viewed from the crankpin side, and behind the flywheel when seen from the other direction.

The Wico contact-breaker is housed in a circular cup-shaped die casting, having apertures for the lead-in wires; it is thus easily attached

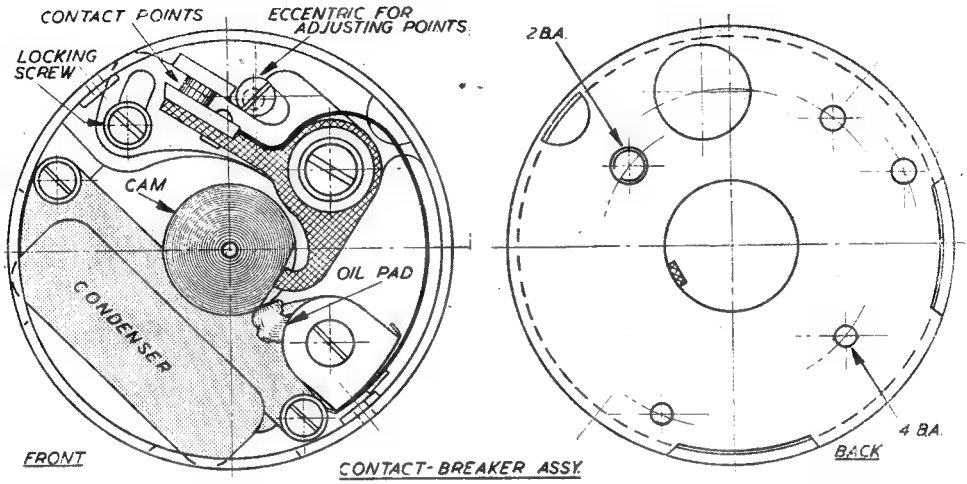


View of the contact-breaker in position also showing the idler gear and pivot nut

to a backplate which can be mounted on the extension of the inner camshaft bearing. There is a raised rim at the back of the casting, which can be skimmed off to leave a flat surface, so that it can be mounted on the backplate with a couple of screws. It would then be practicable to fit a cover, like an ordinary tin lid, to enclose the contact-breaker, and this would be desirable to protect it from dust, but no such provision has been made in this case.

the camshaft. It is much easier to mark the cam *in situ* than to measure the exact angle at the point where the tip of the rocker rests on the cam.

The procedure for this operation is as follows : the contact-breaker is fitted to the engine, with the clamp-screw fairly tight and the lever vertical ; the engine is turned to t.d.c. on the *firing* stroke (make certain that it *is* the firing stroke by seeing that the lobes of both valve



CONTACT-BREAKER ASSY.

Another convenient feature about the breaker is that it has a built-in condenser, which saves having to fit one in the external wiring ; some types of automobile contact-breakers also have the condenser fitted in the casing, but one point worth mentioning is that faulty condensers are not uncommon, and they should be tested before acceptance, to avoid the risk of mysterious ignition troubles.

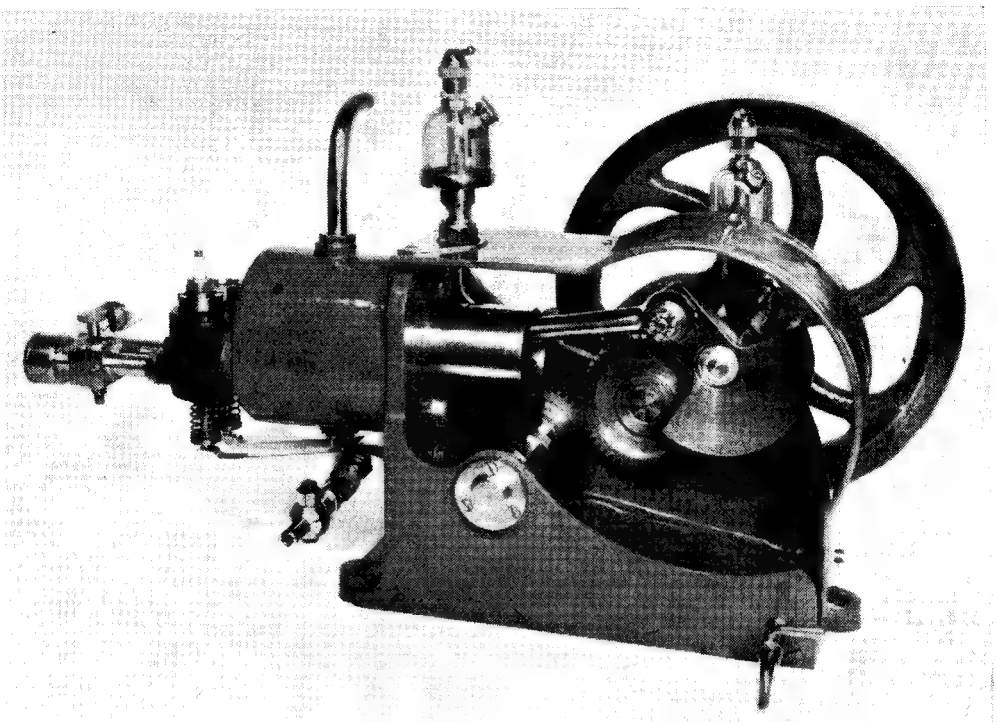
Backplate Casting

This is a simple " banjo," almost identical with that used on the " Phoenix " 15 c.c. engine, and fitted in the same way ; that is, bored to fit tightly over the camshaft bush, the boss being split, and provided with a clamping-screw to regulate the friction. The front is faced flat, and the breaker assembly fixed concentrically to it ; exact truth in this respect, though desirable, is not essential to successful working, as concentric operation of the advance and retard adjustment depends only upon the outside of the bearing bush being true with the bore.

It will be seen that the breaker assembly can be fixed to the backplate in any angular position, and the only practical point which was considered in locating it was to keep the contact points near the top, so as to avoid the risk of oil from the bearing dropping on them (this is a different matter to *creeping* of oil, which cannot be avoided if sufficient oil, or oil vapour, is present). Readers will now understand why I made no attempt to indicate positively the timing of the contact-breaker cam when describing the machining of cams are visible from the top side) and a mark made on the end face of the camshaft, in line with the centre of the rocker pad. Now turn the engine *backwards* to the bottom of the compression stroke (the inlet valve will begin to open), and make another mark on the end of the shaft, also in line with the centre of the pad. The camshaft may now be removed from its bearings and replaced in the cam-turning jig, in such a position that the surface between these two marks can be machined away, as shown in the diagram on page 171, of the February 7th issue. After machining to as smooth a finish as possible, the sharp corners of the cutaway surface are very slightly rounded with a dead smooth file, and polished with fine emery-cloth.

This procedure is suitable for any engine having a solid camshaft, or even where a separate keyed ignition cam is used, but obviously the timing of the cam must depend on the angular position of the rocker pad—a point often neglected by querists who ask for advice on cam timing. If these directions are followed, the ignition timing will be slightly advanced when the lever is vertical ; the best position when starting the engine will be with the lever inclined about 10 deg. towards the flywheel, and the best angle of running advance may be slightly the other way, but is easily found by trial. If desired, limit stops may be arranged, by fitting pins each side of the lever, in the web of the engine casting, but I have not found them necessary.

Contact clearances may be normal—say, 10 to 15 thou.—but are not critical ; they are very



The rebuilt engine ready for mounting on its base

easily adjusted, in this and many other breakers, by means of an eccentric cam and locking-screw. The ignition coil used on this engine is an old polar inductor magneto armature (obtained brand new, in an airtight can, on the surplus market), and fixed under the hollow wooden plinth on which the engine is mounted. If one has a more or less complete Wico Series A magneto, and the coil is intact, this can be used in the same way, and will spark very efficiently on 4 volts, but note that these coils have a very low primary resistance, and thus take a heavy current, at least when starting up. Don't expect to be able to run them on small dry batteries—a good accumulator is essential.

If a trembler coil is used for ignition, it would be possible to use the same contact-breaker, but it should be timed later, as the spark occurs at the "make" and not the "break." There is no evidence that this type of coil gives any advantage, even for slow running or starting, but some users prefer it because they can hear it working when the engine is turned slowly, and thus be sure that the ignition is in working order—at least as far as the trembler circuit is concerned.

(To be continued)

For the Bookshelf

Successful Conjuring for Amateurs, by Norman Hunter. (London: C. Arthur Pearson Ltd.) 382 pages, size 5 in. by 7½ in. Fully illustrated. Price 18s. net.

There are probably many of our readers who are interested in conjuring, either as amateur performers or as mystified onlookers. This book will appeal to both, for it not only explains a large number of tricks and illusions, but it illustrates most of the apparatus sufficiently to enable it to be constructed; there are quite a lot of the gadgets that are neither elaborate nor beyond the equipment of the average workshop or woodworker.

Mr. Norman Hunter is a well-known conjuror with many years of experience in the art of mystifying and entertaining the public, and his book is essentially informative in light and easy style; the explanations are clear and are well supported by numerous illustrations in line and half tone. We commend it to all readers who would wish to take up the art of conjuring as a pastime.

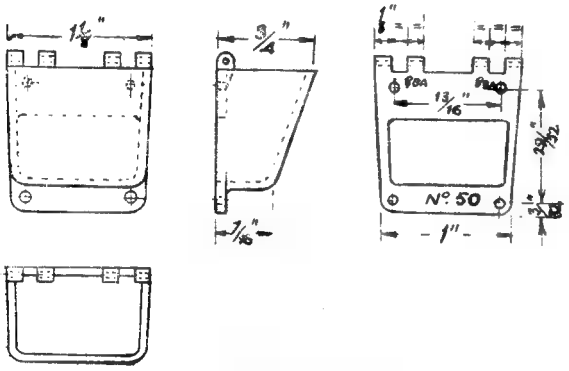
*The Allchin "M.E." Traction Engine

to 1½-in. Scale

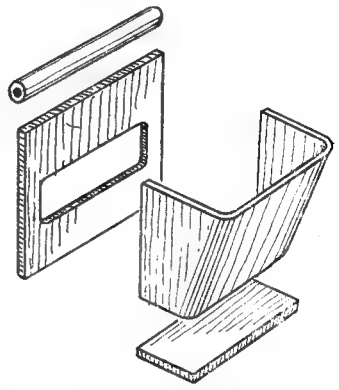
by W. J. Hughes

THANKS to having a "head like a bucket" (due to a severe cold, not a hangover!), there was one point I omitted to mention about the back of the tender in the last instalment. If you examine Photograph No. 5, and also the drawing of the back, you will see that the top corners of the backplate are swaged out to a feather edge. This is so that the half-round beading at the top can go round in a continuous sweep, of course.

If you haven't fitted the plate yet, this swaging is easily done by hammering the corner, resting it on a hard surface, and then touching it up with a file.



The water-pocket



Exploded view of built-up water-pocket

However, if the plate *has* been fitted, the omission may be remedied by sweating on two suitable shaped and tapered-off scraps of brass sheet—rather in the same way as the "filling-in pieces," described later in this present article. If they are nicely fitted, the deception will never be noticed, especially when painted. Meantime, a handsome apology to anyone inconvenienced!

The Water-Pocket

Before we put the bottom on the tender, there are quite a few bits and pieces which it is easier to fit now. In any case, they'll *have* to be fitted before the front is put in, so we might as well make them now.

One of these is the water filling-pocket, which fits on the left-hand side of the tender. If you have obtained a casting from friend Reeves, it will only need cleaning up with a file. I find small riffler-files exceedingly useful for cleaning up castings, by the way—with their curved ends one can so easily get into difficult corners. I have a set of three, of differing shapes—they date back to the days of my youth when I had a motor-bike and used to spend any odd half-hour in whipping off the cylinder-head and polishing the ports, in an effort to get an extra decimal point of acceleration out of her. Ah me! What days those were!

But wipe away that tear and we'll continue. Where were we? Ah, yes, the water-pocket. Well, if you haven't a casting, some odds and ends of brass sheet are called for. The sketch will show how the thing is built up. First of all you need a piece 1 3/16 in. square of 16-gauge for the back. Set out the rectangular hole 7/16 in. by ½ in., and cut away the waste either by drilling overlapping holes in the usual way, or with a piercing saw—but don't file right to the lines yet; leave about 1/32 in. of waste all round.

Now on a scrap of 18-gauge sheet set out the development of the pocket itself. Bend it to shape—note in the plan that the corners are well-rounded—and trim off the top and bottom edges to be flat. Next cut a bit of 16-gauge brass to 7/16 in. by 1⅛ in. for the bottom, and take a 1 3/16 in. length of *thick-walled* brass or copper tube ⅛ in. diameter (preferably the former) for the hinge-knuckles. If you haven't any suitable tube, drill two half-inch lengths of ⅛ in. diameter brass rod lengthwise. Put a piece in the three-jaw, centre the end, and use a No. 54 drill in the tailstock chuck. Use fastest speed, and don't be in a hurry! When you've made two, they can be used instead of the one length of tube.

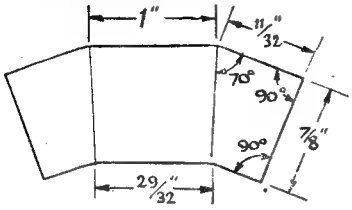
Clean up all the mating-surfaces, anoint with flux, and fix all the pieces together with thin iron-wire. Now you can silver-solder the lot together at one heat.

*Continued from page 248, "M.E.," February 21, 1952.

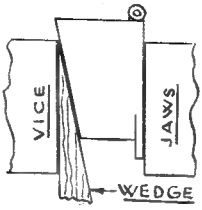
Warm them up gently, so as to prevent the flux "bubbling" and disturbing anything; then bring to dull red heat, dip the Easyflo in the flux, and touch it to all the joints in turn.

Allow the job to cool to "black heat," remove the iron wire, and dump it—the job, not the wire!—in pickle. (If you are a tyro, and haven't any, follow "L.B.S.C.'s" oft-repeated instructions for making and using same.)

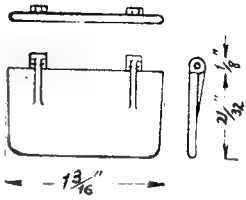
When the job is taken out of the pickle, scrub it well under the tap, dry it off, and it is ready for the finishing.



Development of front of water-pocket



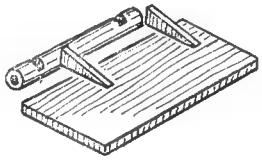
How to hold pocket in vice



Water-pocket lid

Cleaning Up

This pocket is rather difficult to hold in the vice, being tapered both ways, but if you shape a strip of wood to the same taper as the front,



Exploded view of lid

this will help. Put it on the front with the taper the other way round, and you will have two parallel surfaces which can be gripped in the vice—but don't squeeze it *too* hard, or you'll distort the pocket.

First of all, trim off the side-edges of the back until they are flush with the pocket itself; then clean up the bottom of the pocket, rounding the corners to agree with the drawing. Next, mark out the hinge-knuckles, and file away the surplus tube. Finish filing the hole in the back to size, and round the two bottom corners of the back.

Set out the fixing holes. The two upper ones are drilled No. 50 and tapped 8 B.A.; the two lower ones are drilled No. 50 likewise, but to clear 10 B.A. Incidentally, if you have already drilled the corresponding holes in the tender-side, drill and tap *one* of the upper holes only at first. Fix the pocket in position with a single 8-B.A. screw through this hole, and mark the positions of the other three through the existing holes in the tender side, using a bent scriber. You can then drill them where marked, and thus ensure that they all coincide.

Water-Pocket Lid

For the lid, cut a piece of 18-gauge brass rather oversize, and take a 1-in. length of the thick-walled ⅜ in. diameter tubing. With a very thin file or a hacksaw, cut two shallow notches across the latter at centres ¾ in. apart, and cut two tiny triangular scraps of 18-gauge brass for the two lugs or ribs on the top of the lid—make these rather oversize, too.

Clean up the mating surfaces, apply flux, and place the lid against the tube. Jam the lugs into the notches and up against the lid, and silver-solder with Easyflo as before. It isn't really necessary to bind the bits together this time, but, of course, you can if you want to.

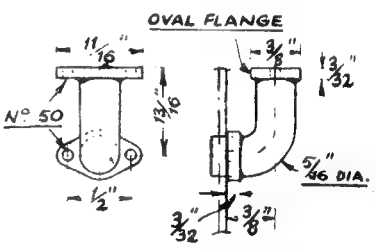
After pickling and washing, trim the waste off the ribs, and mark out the hinge-knuckles. File off the surplus tube, but be careful to fit these two knuckles very nicely between those on the water-pocket.

Now file the lid itself to size, but note that it should project 1/32 in. over the front and sides of the pocket. When fitting the lid, use a piece of wire of suitable thickness (according to the bore of tube) as a hinge pin. When the lid is finally filed to shape, round off the corners and edges, including those on the lugs.

The hinge-pin will eventually be riveted over very slightly at each end, but leave this for the time being.

Stand-Pipe for Water-Lifter

Bro. Reeves has prepared a casting for the



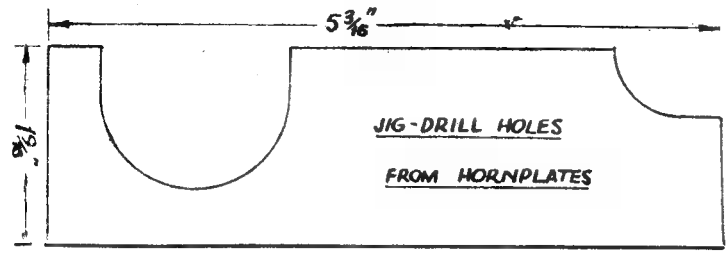
Stand-pipe for water-lifter

stand-pipe, but, of course, it can be built up. If a casting is being used, the passage will be cored through, but it will help to clean it up a little by passing through it a rolled-up strip of emery cloth. Grip the casting in the vice, and pull the emery vigorously back and forth to polish the bore.

Now place the casting in the four-jaw chuck so that the uppermost flange is outwards, and

so that the hole runs true. Face up the end with a knife-tool, and drill the hole out to ¼ in. diameter, taking it only 1/16 in. deep. Then replace the stand-pipe in the chuck so that the lower flange and its spigot run true. Turn the spigot to 5/16 in. diameter, and face up the flange.

Remove from the chuck, and set out and drill the bolting holes No. 50. Trim up the casting generally with fine files and emery cloth, and put it in position in its hole on the right-hand side of the tender. Take care that it is truly vertical, and then jig-drill the bolting-holes through the side. Tin the spigot and flange, and also the tender-side where the latter fits. Fasten the stand-pipe in position, using 10 B.A. brass screws with the nuts outside, and "sweat" the joint by applying a hot soldering-bit to it, or by using a small blow-pipe. Tighten the nuts, which may have been slackened by the heat, and solder around the heads inside to ensure water tightness.



Strengthening plate for tender

To make the built-up stand-pipe, it will be necessary to make a sharp bend in a piece of 5/16 in. diameter copper pipe. This can be done without "loading" the pipe, if it is taken steadily and carefully, and provided that it is annealed whenever it shows signs of hardening. (Copper is annealed by heating to cherry red and quenching immediately in cold water).

With a round file, make a groove in the end of a piece of hardwood to a radius of ⅛ in. and use that as a bending-jig, making the bend at some distance from the end of the pipe so as to allow plenty of leverage. Watch for signs of flattening on the outside of the bend, and anneal frequently as a precautionary measure.

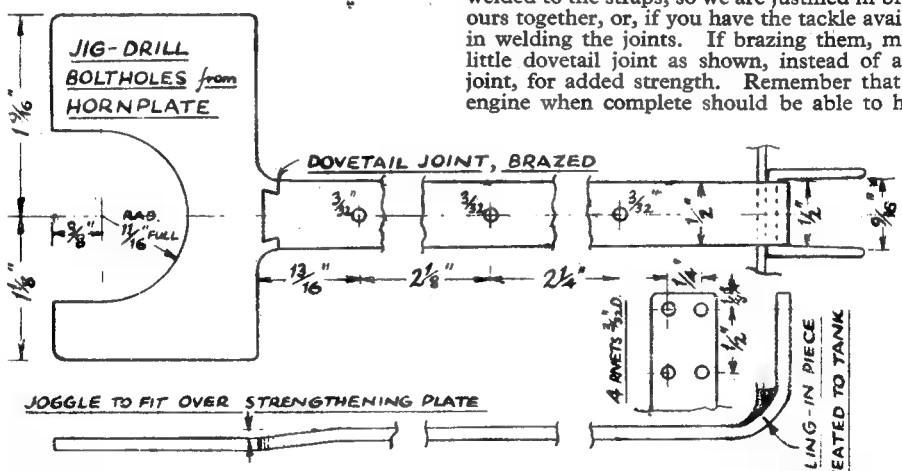
When the bend is complete, cut off the surplus —don't forget to allow sufficient for the spigot on the lower end—and make a couple of oval flanges from 13-gauge brass sheet. Fit these to the pipe, having cleaned the joining surfaces, and silver-solder the joints. Pickle, clean up, and fit to the tank as described above.

Strengthening Plates

As we had previously noted, the tender-sides are sandwiched between the hornplates and two strengthening plates. The latter are cut to shape from 18-gauge mild-steel plate—preferably bright—as shown in the drawing; only the two chief dimensions are given, as the cut-out parts can be marked from the tender itself.

Draw Straps

The draw-straps with their palmed-out ends *could* be cut from the solid 13-g. B.M.S. plate, but in the prototype the end-plates are forge-welded to the straps, so we are justified in brazing ours together, or, if you have the tackle available, in welding the joints. If brazing them, make a little dovetail joint as shown, instead of a butt joint, for added strength. Remember that your engine when complete should be able to haul a tidy load, and those joints will be called upon to take most of the stress. (That'll be the day, boys, as the Western Brothers say!)

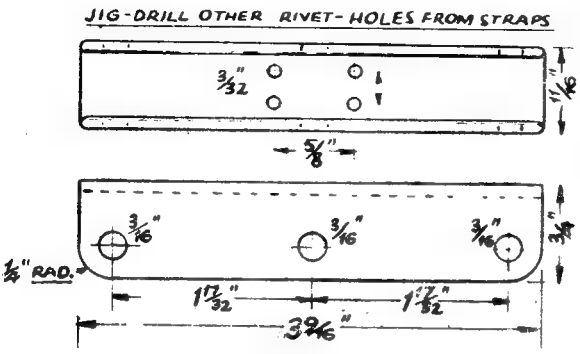


Elevation and plan of draw-strap

For the straps, you will need two pieces 7½ in. long of ⅛ in. × 3/32 in. (or 13-g.) B.M.S., which allows for the joint and a slight surplus. The plates or palms may be cut from 1¼ in × 3/32 in. B.M.S., or from 13-g. sheet, and the joints should

be fitted carefully so that the components are square with each other.

Brazing spelter should be used to make the joints, in preference to silver-solder. By the way, *don't* pickle these joints when made. Use the end of an old file to clean off the borax, and when the joints are cleaned up they should be almost invisible if you have been careful.



Elevation and plan of drawbar

The "set" or "joggle" to allow the palms to fit outside the strengthening plates is done easily in the vice, but note that you need ■ left-hand and a right-hand one! Do not drill the rivet-holes or bend the back ends of the straps until the draw-bar itself is made and fitted to the back of the tender.

The Drawbar

This is best made from a malleable-iron casting —Reeves again!—in which case it only needs cleaning up and the holes drilling. Don't drill the end rivet-holes yet.

Alternatively, it may be milled from solid steel bar, which is how I made my first one—the one which vanished from an exhibition with the rest of the tender! A piece of $\frac{3}{4}$-in. square bar will be needed. It can be milled to $\frac{11}{16}$ in. thick, or the surplus $\frac{1}{16}$ in. may be faced off in the lathe, with the bar in the four-jaw, but note that the full width of $\frac{3}{4}$ in. is retained.

The channel is then milled out with a $\frac{1}{2}$-in. end-mill, with the bar mounted in ■ machine-vice on the vertical slide. (That is, of course, assuming that, like me, you haven't a pukka milling-machine). The thickness of the back web is 3/32 in., by the way. The webs of the channel section must then be filed internally to thin them down at the edges to $\frac{1}{16}$ in.: see end view. File to length, drill the holes, and round the corners.

Fixing the Drawbar

The completed drawbar should now be clamped in position on the back of the tender—we have already marked out for it—and one of the rivet-holes drilled right through. If you haven't ■ tool-maker's clamp large enough to hold the bar in place, a G-cramp will be useful; failing that, mark out the position of one hole, centre-punch it, check carefully with the bar placed in position, and then drill it.

Clean off the "fash" from the inside of the hole, insert ■ 3/32-in. iron rivet from *out*side, and rivet over the head *in*side, using ■ set in the vice to support the outside head. If you haven't one for 3/32-in. rivets, make one as you did for the 18-g. wire, but use a 5/32-in. ball to make the cup.

Check again to see that the bar hasn't moved while riveting has been taking place, and then drill another hole right through. Insert and head another rivet, and finally drill holes for and fix the other two rivets.

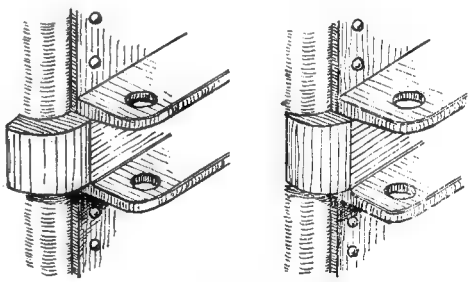
Fixing the Drawbar Straps

Set out and drill the three 3/32-in. holes in each strap to the dimensions given in the drawing. Now, looking at the plan view in this diagram, you will note that as the strap has to be bent round the back of the tender and riveted over the end of the drawbar, ■ gap would be left on the inside of the curve, owing to the thickness of the back and of the back web of the bar.

This needs filling in, and a bit of $\frac{1}{2}$ in. × 5/32 in. or $\frac{3}{16}$ in. brass or copper bar may be used. Bend one end of it to ■ $\frac{1}{4}$-in. radius to fit the back corner of the tender—use ■ piece of $\frac{1}{2}$-in. rod as a mandrel; file the end square, and cut off the bend. Sweat it in place on the corner of the tender, and file off the surplus. The sketches show the idea.

Clamp the draw-strap in position on the tender-side, and carefully bend the end round, using a hammer with ■ piece of wood interposed to "persuade" it. It won't go quite all the way due to the natural springness of the material, and it will be necessary to remove it from position and finish the bending on a mandrel.

Now re-clamp it in position, and mark off



(*a*) "*Filling-in piece*" *sweated to curve of tender* (*b*) "*Filling-in piece*" *filed off flush*

the waste at the end—the lug should overlap the drawbar by $\frac{3}{4}$ in. Remove the strap, cut off the waste and file the end square, and set out the centres for the four end rivets (see diagram). Centre-pop, and drill the holes 3/32 in. diameter.

Replace the strap on the tender-side, check its position carefully, and clamp it in position. Drill the rivet-holes in the side of the tender, using those in the strap as ■ jig, and insert and head the rivets. Use iron rivets, either flat-

headed or round-headed. To complete the fixing of the strap, drill for and insert (one at a time) the four rivets in the end lug and through the drawbar. Here again it will be necessary to place the heads of the rivets outside, and rivet the inside ends over, because we can't get the hammer-head between the webs of the drawbar.

Finally, fix the other draw-strap in exactly the same way, and then carefully tin all the inside heads of the rivets, not only to protect them from the water, but also to ensure that they are absolutely leak-proof. And don't forget—if you use an acid flux, every trace of it must be removed!

The Drawbar Pin

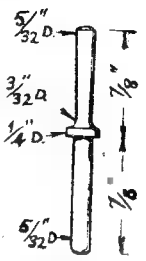
By now you may be getting a little cheesed-off with riveting, so here is a nice little turning job—the draw-bar pin.

Chuck a stub of ¼-in. dia. mild-steel rod, and turn it to 5/32 in. dia. for a length of ⅞ in. Slightly round the corner, and part off to 1¾ in.

Reverse in the chuck, and, using a round-nose tool, turn the tapered end to the sizes given, leaving the central 1/16 in. to full diameter. (If using "black" rod, take just a skim off here to clean it up.) Again round the end as indicated in the drawing.

Now grip the parallel part of the pin in the vice, using clamps, of course, and bend the tapered end at right-angles, as shown in the general arrangement drawing in the December 20th, 1951, issue of THE MODEL ENGINEER, with two or three light taps with a hammer. Simple, isn't it?

Incidentally, if you look at Photo No. 2, you will notice two drawbar pins. However, the nearer one is not a standard fitting, and should be omitted. Mr. Earnshaw, the previous owner of *Royal Chester*, told me that it had been picked-up from some scrapped agricultural machine, and used as a matter of convenience.



Drawbar pin

By the way, in case the tyro wonders why there are *three* alternative holes for the pin, when obviously only the central one is needed for towing, the answer is that the others were sometimes used when "shunting" the threshing-machine to and fro in awkward stackyards, where there was usually little room for manoeuvring. Satisfied?

(To be continued)

Improvement to the Grayson Lathe

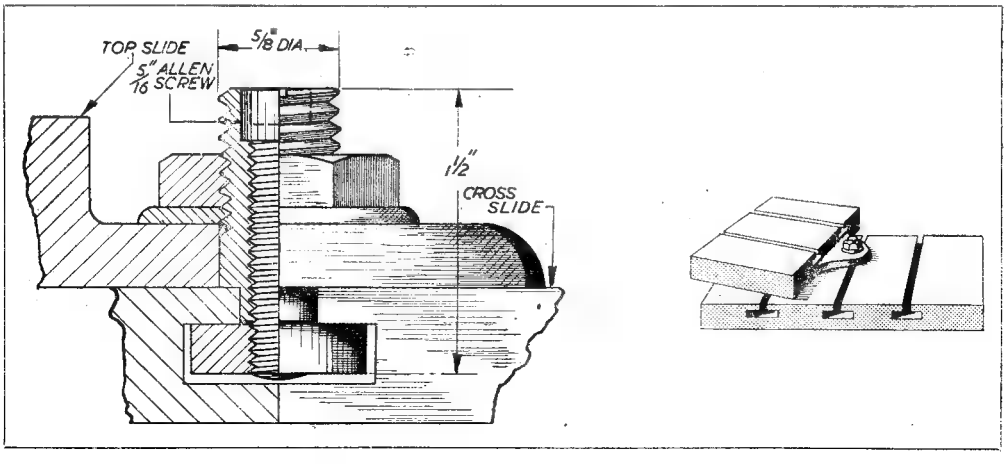
I have recently effected an improvement to the top-slide of my Grayson lathe. Maybe this idea would be useful to other readers using this type of lathe.

The top-slide was originally anchored to the cross-slide by a ⅜-in. bolt and nut, the head of the bolt being located in a T-slot of the cross-slide.

With this arrangement it was very difficult to set the top-slide with any accuracy for taper turning.

I think my sketch more or less explains the modification. The ⅝-in. pivot pin is tenoned in a slot of the cross-slide and held in position by a 5/16-in. Allen screw passing through its centre. The pivot pin thread is ⅝-in. B.S.F. and the enlarged hole in the top-slide is reamed.

—R. HARTWRIGHT.



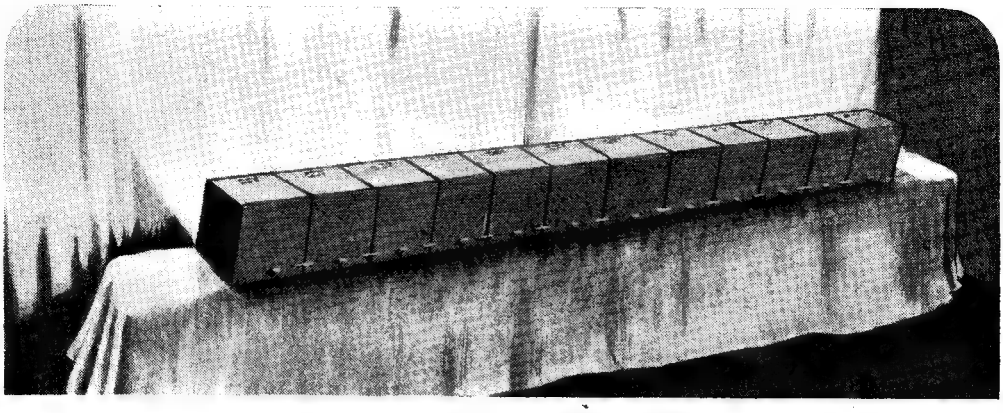


Fig. 1. General view of assembled footlights

A SET OF STAGE FOOTLIGHTS

by W. J. Baker

WHEN asked by the local drama group to build a set of stage footlights, my first impulse was to regard this as a pretty straightforward job. My confidence was sadly shaken when I was confronted with the following riders to the proposition :—

(a) The initial cost must be low, as funds were strictly limited.

(b) Lighting efficiency should be as high as possible, the available wattage being restricted.

(c) The set must be transportable and simple in dismantling and assembly. (It had to stow away in a corner of a van for transportation to other villages.)

(d) The general appearance and flexibility in operation should approach professional standards.

Most of these specifications it will be seen, are flat contradictions of each other. A tall order, indeed ! However, after much experiment with various methods, a design was evolved that not only manages to square up with requirements, but has the added advantage that it needs only the simplest of tool kits for its construction. It is hoped that the following description may help to prevent headaches to others of the fraternity who may be called in to cope with similar jobs !

Fig. 1 shows the general appearance of the assembled units from the back, or audience viewpoint. The angle of illumination can be adjusted to any requirement—a very useful feature for eliminating those shadows which will insist on appearing in the wrong places.

A three-colour choice is available by switching, and any desired concentration of light in a particular area is possible. Nevertheless, the whole installation is assembled quickly and can be dismantled in a few minutes. It packs down into two 6 ft. lengths, while the boxes detach in sections of three and fit into a space of 27 in. × 18 in. × 19 in.

Now to the construction. First, the individual footlight, or "float." Owing to the efficiency requirement and the portability clause, it was decided to use a separate compartment system rather than the simpler trough of lights. The question of construction then arose. I could imagine a no more monotonous task than the turning up of twelve identical boxes ; furthermore, there wasn't much point in doing so when a kindly Providence is always prepared to supply an identical article for the sum of 2s. per box. I refer, of course, to the humble biscuit tin, which is almost ideal for the purpose, being both light in weight and soundly constructed. So biscuit tins it was. One tip here : be sure to get reasonably new ones—if possible, pick them yourself, as boxes ordered at random are liable to be badly battered. (It's also worth remembering, too, that your shopkeeper is supplying them as a favour and that he doesn't make a ha'penny out of that two bob.)

For constructional details, see Figs. 2A, 2B, 2C. It should be noted that the dimensions given are those actually taken from the originals, but that these should be taken as an approximate guide throughout, as individual makes of tins may vary somewhat in size. Incidentally, when starting on the box, it is advisable to cut a sheet of metal to the size of the back and to rivet or bolt it into position. This is nothing more or less than to cover up manufacturer's marks that may be found there !

The ventilator holes at the top are perfectly straightforward and need no comment. At the other end of the box (note, by the way, that these boxes are not cubical) cut a rectangular hole 6½ in. × 2 in. As the cut edge is a lethal weapon to fingers, the simplest way to deal with this is to cut this hole a little smaller than given above,

and turn the edges back neatly. If, however, you joy in craftsmanship, various alternatives suggest themselves. One is to take a piece of copper wire (about 10-s.w.g.) and cut a slot down its length. Bend into shape and force-fit it around the edge of the hole, soldering it into position. Then cut a piece of gauze to size and fix over the hole, inside the box, by means of a metal plate cut as shown in Fig. 3. This can be either bolted or riveted in position.

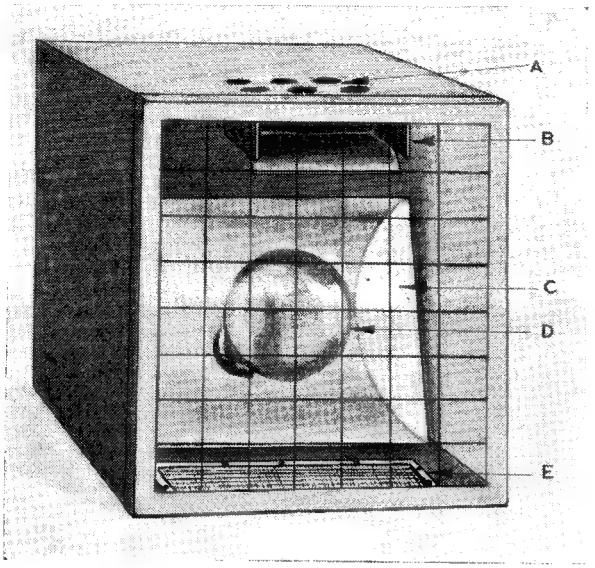


Fig. 2A. "*A*"—*ventilator*; "*B*"—*light-trap*; "*C*"—*reflector*; "*D*"—*lamp-holder*; "*E*"—*ventilator gauze.* (*Bottom light-trap not shown*)

The rectangular hole and the ones already drilled on the top are purely for ventilation purposes. This ventilation business is a snare to the unwary, for, if inadequate, the operation of the footlights will be not only costly in lamps and gelatines, but altogether unreliable owing to rapid perishing of cables, etc. Ventilation, however, brings its own problems, as no light must appear where it is not wanted. Light-traps must, therefore, be constructed.

Details of these are shown in Fig. 4A. Cut out from sheet metal as shown, and bend carefully so as to get absolutely flush fitting; then run solder in the edges so that no light can escape. Glue thin strips of felt on to the top flanges to take up any slight irregularities in the top surface. (For the sake of clarity, this has been omitted from the drawing.) The bottom light-trap is not shown, as in the case under description none was required—the spill of light from the lower aperture could not be seen by the audience. If necessary, however, a simple curved plate blackened on the underside should suffice.

Next, the lamp-holder and fittings. Cut a wedge of wood as in Fig. 4B. Note that the cutaway portion at the base is merely to avoid a strengthening rib fitted at the back of some boxes. It may, therefore, be dispensed with in some cases. Drill the wood as shown with the hole parallel to the under-edge. Connect about 1¼ yards of cable (circular rubber cabtyre) to a batten-type lampholder and pass the free end of the cable through the hole in the wooden block. Pull through until the batten-holder lies flush on the sloping edge and secure the holder with ½ in. No. 4 wood screws. (In the present case bakelite batten-holders were used, as at the time of construction nothing else was available, and in any event have proved very satisfactory. Brass batten-holders are now in better supply, however, and make a stronger job; if these are used, the dimensions of the block may have to be modified to bring the lampholder forward a little.) Drill an oversize hole at the back of the box and fit a

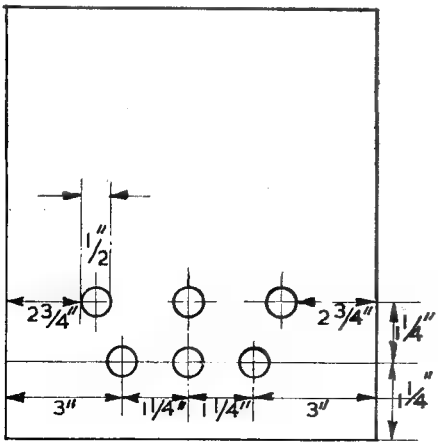


Fig. 2B. *Top ventilator holes*

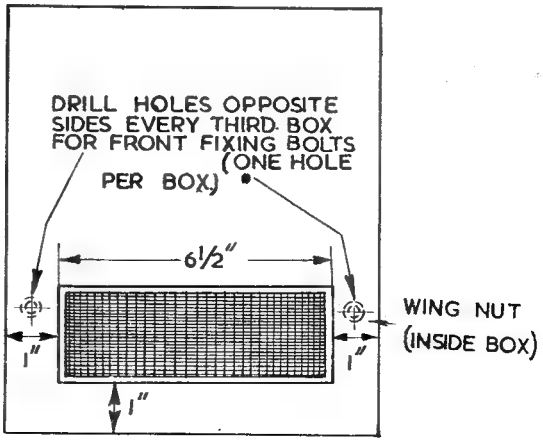


Fig. 2C. *Bottom ventilator*

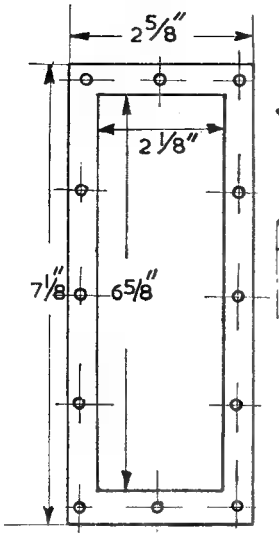


Fig. 3. Clamp for bottom ventilator gauze

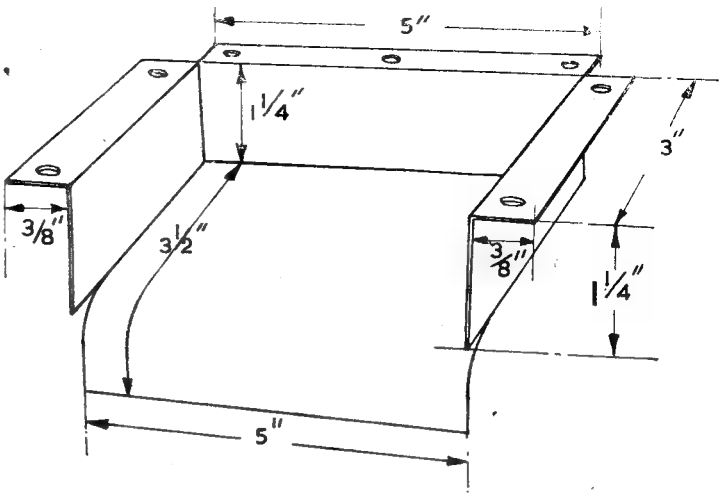
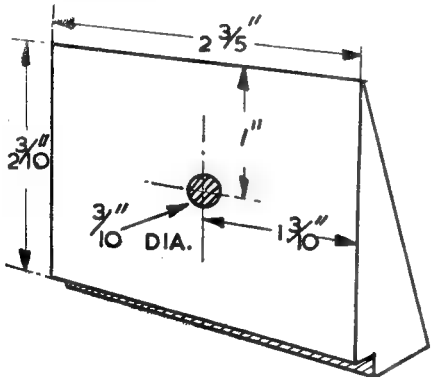


Fig. 4A. Dimensions of top light-trap



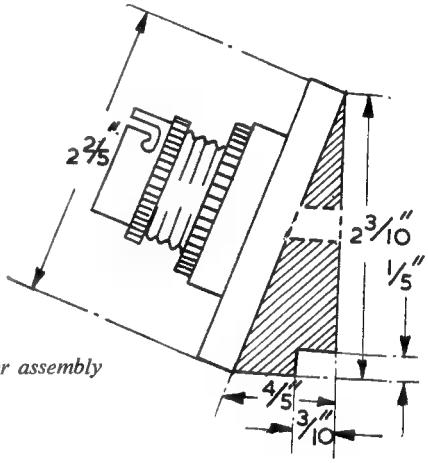


Fig. 4B. Details of lampholder assembly

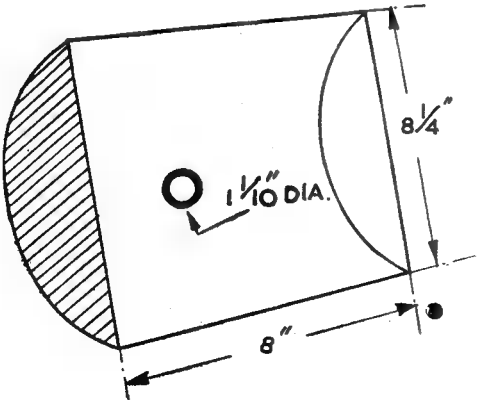


Fig. 5. Details of reflector

rubber grommet (obtainable at radio dealers), but do not pass the cable through at the present.

The reflector is made from a circular sweet-tin cut lengthwise to dimensions given in Fig. 5. The half-lid is riveted or bolted into position, and a hole cut out to allow the batten holder to come through (note again previous remarks *re* approximate dimensions).

(To be continued)

IN THE WORKSHOP

by "Duplex"

No. III—Scraping, Frosting and Figuring Flat Metal Surfaces

THE hand scraper is used in several ways for finishing metal surfaces and the most important, and perhaps the most generally employed, is in the production of flat surfaces found, for example, in the work slides of machine tools. If the bed of a precision lathe is examined, it will be found that the surfaces on which the saddle slides have been hand-scraped to a high degree of accuracy. Furthermore, once the required standard of accuracy has been attained, the scraped surfaces are usually left in this condition without further embellishment. The bed slides then have a very pleasing and workmanlike appearance and the small depressions that are necessarily left by the scraping process serve, in some measure, as oil reservoirs for lubricating the slide.

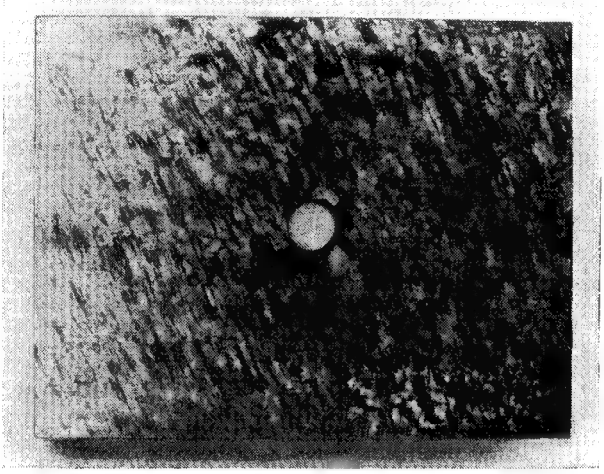


Fig. 1. A small, scraped surface plate

Examination of the tool marks will show that the scraping has been carried out in a methodical manner, but that no definite geometrical pattern has in this way been produced. It is, of course, possible to go over the work again with the scraper so as to leave a symmetrical pattern composed of crescents, squares, or other shapes, but this will in no way improve the accuracy of the surface, and the superimposed design will hardly show up clearly against the background formed by the original scraper marks.

If the geometrical pattern is to stand out clearly, a plain background will have to be first established; this could be done by careful treatment with a rubbing-block charged with abrasive material, but the accuracy of the surface might then be impaired.

A plain, ground surface can, of course, be embellished with a pattern of scraper marks, but this would serve no really useful purpose, as the mating slide is always hand scraped to establish even contact and these tool marks will themselves help to maintain the lubrication of the slide.

Although many prefer a plain filed finish on the non-working surfaces of castings and flat bars or link-rods, there are some who would rather see these parts ornamented by a series of regular scraper marks which show a variety of patterns by reflected light. Nevertheless, too much embellishment is apt to become tiresome, and the plain filed finish has much in its favour.

Apart, therefore, from forming flat surfaces, the use of the scraper for fancy work is of little real importance; various ways of ornamenting the work surface will, however, be dealt with later.

Those who hold a less sober-minded view should examine the finish on a first-grade surface plate, for it will be at once apparent that the aim has been to produce a flat surface irrespective of the pattern left by the scraper, and one might, perhaps, be a little suspicious of a surface plate that showed a delicately traced pattern on its working surface. The small surface plate illustrated in Fig. 1 was specially made to provide a flat reference surface when scraping a machine component of awkward shape; the tool marks, here, follow a definite working plan, but give no more than a general frosted effect.

Scrapers

When tackling a machined iron casting like the square table of a drilling machine, it will be found an advantage to use a heavy, rigid scraper that will enable the surplus metal to be removed without unnecessary loss of time or effort.

At the outset, it is usual to remove all tool marks left on the machined surface of the casting and, for this purpose, a scraper made from a 10 in. file is not too large, although for finishing and for lighter work a 6 in. or 8 in. file will serve better. A discarded, smooth file is generally chosen for making the tool, as the steel is of the right quality to give a keen and lasting cutting edge. A hand file, having flat sides and slightly bellied faces, is a convenient shape; but for finishing and for light work, a thin and less rigid blade will be found easier to use.

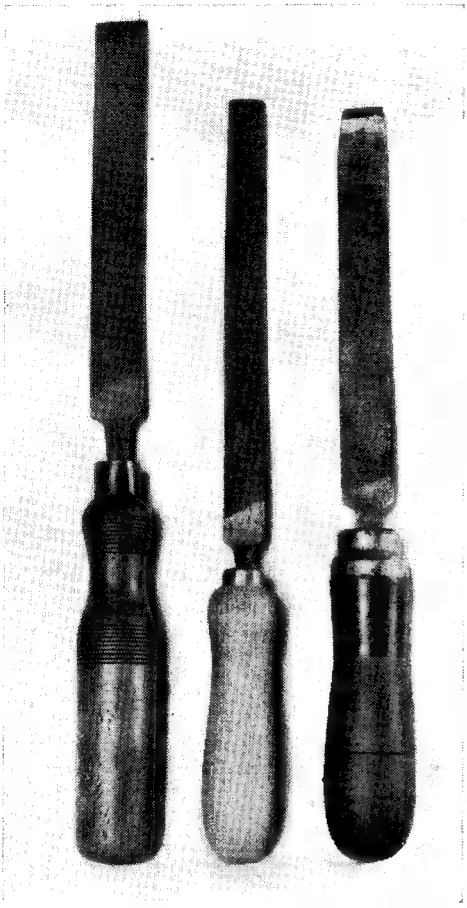


Fig. 2. Three scrapers made from files

When determining the form of the cutting edge, it should be borne in mind that the scraper will have to be resharpened at frequent intervals, particularly when operating on the tougher kinds of cast-iron. The cutting edge should, therefore, be of simple form and of a shape that can easily be maintained during sharpening on the oilstone. The file must first be fitted with a handle to give a comfortable and secure hold, and the teeth on each side of the blade are then ground flat so that the forward end of the tool is at the same time thinned to about half its original thickness. The front edge is formed by holding the edge vertically on the grinding rest, and raising and lowering the handle with the edge in contact with the periphery of the grinding wheel. In this way, an almost straight edge with slightly rounded corners can readily be formed. After the edge has been ground to shape, it is smoothed and sharpened on an oilstone.

An India oilstone is quick-cutting and will serve well, but for finish scraping to leave a really smooth surface, the scraper is best honed on a hard Arkansas stone. The flat sides of the scraper are honed, as shown in Fig. 4A, by moving the tool to and fro with the blade held at a small inclination to the surface of the stone. The front face is applied to the stone with the blade held vertically, and the tool is then moved backwards and forwards either with the blade maintained in line with or across the long axis of the stone, in the manner illustrated in Fig. 4B and C.

If, at the same time, a rocking motion is given to the blade, the edge will be honed slightly curved along its length. However, where this curvature is too pronounced, the scraper will take only a narrow cut and will tend to form shallow grooves in the work instead of scraping a series of almost flat areas.

To enable a wider cut to be taken, a flat can, however, readily be stoned on the centre portion of the cutting edge, if, as shown in Fig. 5, a honing jig is employed.

The scraper is held against the guide strip attached to the base of the jig, and the stone is then worked to and fro along the edge of the tool.

For this operation it is advisable to use the side face of the stone, for unless the oilstone is of the hard Arkansas variety, grooving of the surface will in time take place.

The Scraping Operation

When forming a flat surface, on a drilling machine table for example, the flat reference surface is provided by a surface plate scraped to a high degree of accuracy, and the size of the plate should be large enough to accommodate the longest diameter of the work without overlap. After the surface of the plate has been carefully cleaned, a thin, even layer of marking compound is applied. Engineer's Marking, supplied by Messrs. Stuart of Clevedon, Somerset, has been found excellent for this purpose, and it can be evenly and thinly spread by means of a strip of soft leather glued to a slip of wood.

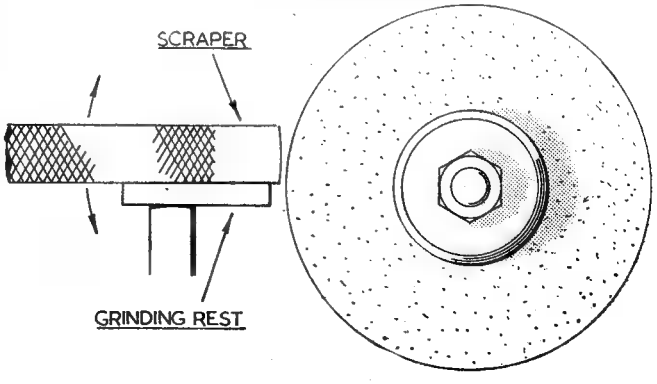


Fig. 3. Grinding the end of the scraper

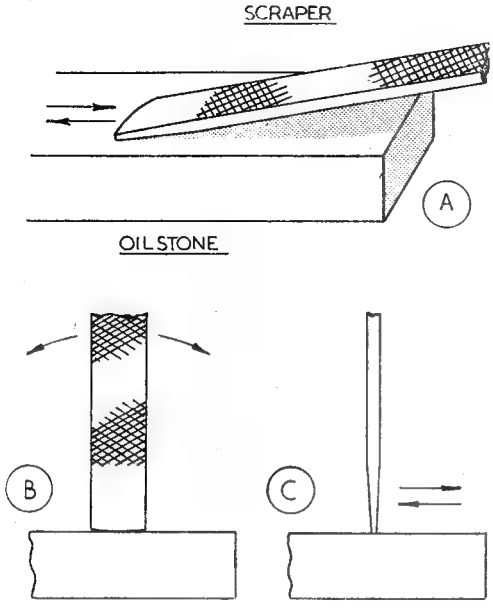


Fig. 4. Oilstoning the scraper : "A"—honing the side faces ; "B" and "C"—two methods of stoning the end face

If the work is now applied to the plate and given a slight rubbing movement, any high spots will be shown up by areas of blue marking. But before starting to scrape, it is essential to make sure that the work lies flat and does not rock on the surface plate. If rocking is present, the high spots at opposite corners or sides shown up by the marking should be carefully filed or scraped until even bedding is obtained.

At first, heavy cuts can be taken with the scraper to remove any isolated high spots, and, as the work proceeds, the areas of contact will become larger, and will finally meet together when perfect contact is established between the work and the surface plate. Towards the end of the operation, only a very thin layer of marking should be used and the scraping cuts should become progressively lighter. Throughout the work, the scraper should be plied first in one direction and then in a direction crossing the first at right-angles ; in this way, chattering of the tool and ridging of the work surface will be avoided, and at the same time the scraper will be found to cut much more freely. The correct angle at which to hold the scraper, to obtain free-cutting without digging-in, can best be found by experiment, as this is largely dependent on the angle of the cutting edge, as well as on the kind of material being worked on. As soon as the cutting edge becomes dulled and the scraper ceases to bite or cut freely, resharpening is necessary if a smooth finish is to be imparted to the work.

The work surface should be kept free from chips, and the scraper should be cleaned with a rag before being applied to the oilstone ; moreover, care should be taken to keep the metal chips away from the hands, as these sharp spicules cause painful splinters.

Frosting

As we have seen, the scraping is carried out by working as far as possible along diagonally crossing lines, and this in itself may well leave the finished work with a satisfactory appearance, although it may be patchy in places.

To obtain a uniform and regular finish,

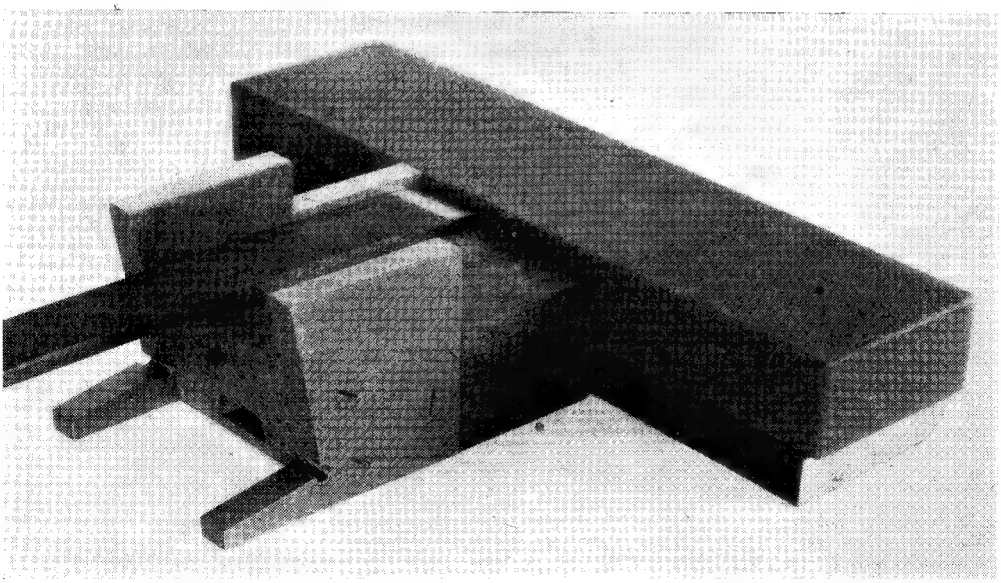


Fig. 5. Using a honing jig for sharpening the scraper

therefore, a series of light finishing cuts may be taken over the whole of the work surface without materially impairing its accuracy. For this purpose, the scraper is worked in parallel lines across the work by taking a series of short strokes ; if this is then repeated in a direction at right-angles to the first, a uniform, frosted effect will be produced that will vary in appearance according to the direction of the reflected light.

This method of finishing can also be applied to filed cast-iron or steel work, and may even be employed for finishing flat, mild-steel parts that have had no preliminary treatment. Good quality mild-steel usually has a smooth, clean surface, and a few passes with the scraper may then be enough to give a satisfactory frosted finish. To get the best results it is advisable to carry out some preliminary practice on a piece of scrap material, for the object, here, is to acquire the knack of making a form of scraper mark that can be repeated all over the work. The scraper can either be given a short, straight push forward so as to cut a roughly square mark, or the cut can be made by working the scraper along a curved path to form a figure of corresponding shape.

The actual form of the marking matters little, as in the final result the marks will overlap, but if possible the cuts should be uniformly repeated all over the work surface. The greater the curvature at the end of the scraper, the narrower will be the marks formed, and a better appearance is gained by reducing the size of the markings on small pieces of work.

The way in which the first series of markings is formed is shown in Fig. 7, and the second series is then cut at right-angles as illustrated lower down on the work ; next, as shown in the right-hand figure, the two lines of cuts are repeated until the whole of the work surface is covered and the background is obliterated.

When scraping steel in this way, cutting will be easier, and the tool will keep sharp longer, if soap solution is used as a lubricant ; moreover, this will help to give the tooled surface a bright, silvery finish. A piece of soft-soap about the size of a pea is dissolved in, say, a spoonful of water, and the solution is brushed over the work in a thin layer with a piece of rag or cotton wool. B.S.A. Safetypaste, which is used for protecting gun barrels after cleaning, is excellent for this purpose, when made into solution, as it prevents corrosion as well as promoting free-cutting.

Figuring

The term figuring may be used to describe embellishing the work surface with a series of regular and evenly-spaced scraper marks of some particular geometric shape. As already mentioned, a plain background will be required if these marks are to show clearly, and, to obtain regular spacing, it is advisable first to mark-out the work with pencil lines.

When embarking on this work, however, it must be borne in mind that any error in applying or guiding the scraper will result in an unsightly mark that can only be corrected by first renewing the work surface, and then making a fresh attempt.

From this it will be clear that some dexterity is required to obtain a satisfactory result, and for most people this skill can only be acquired by practice. Surely no metal worker, however optimistic, would expect that he could cut even simple designs with a graver at the first attempt. Although written instructions may be of some help, they cannot of themselves impart manual skill.

Bearing in mind these difficulties, we generally put on a frosted finish which requires some knack but very little special skill.

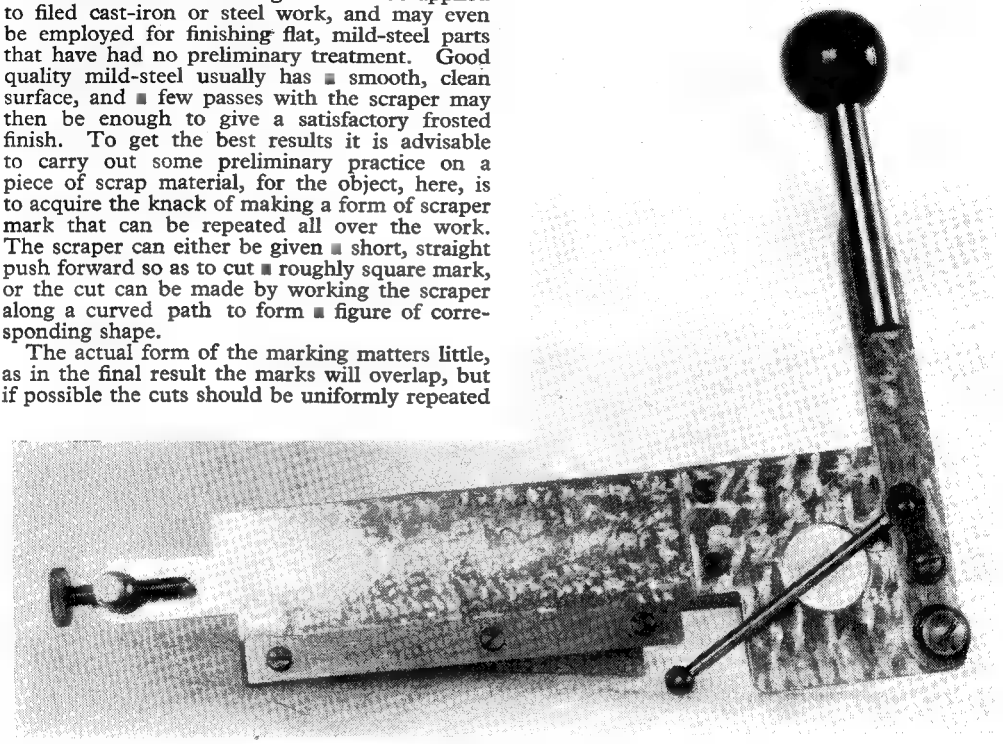


Fig. 6. An example of frosted work

After a little practice, it will not be found difficult to scrape a passable pattern formed by a series of crescents, and a moderate attempt is illustrated in Fig. 8. For this work, the end of the scraper must not be too curved, or the body part of the crescents will appear too thin. The scraper, held at an inclined angle of some 60 deg., is started at the far edge of the work and is then drawn towards the operator along a curved path inclining towards the right.

In this way, the scraper at starting cuts a thin line corresponding to the upper horn of the crescent, but this line gradually broadens as the breadth of the tool's edge comes to lie across the line of the cut ; finally, with its cutting edge still kept parallel with the far edge of the work, the scraper is carefully swept to the left to form the lower horn of the crescent.

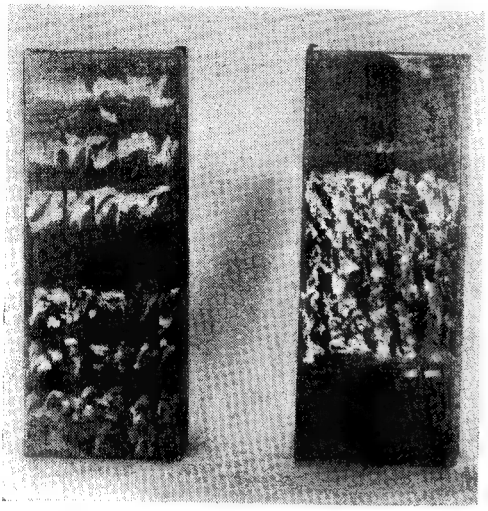


Fig. 7. Showing the three stages in frosting with the scraper

Fig. 8. An example of figuring the surface with crescents

Needless to say, during this operation the scraper must be firmly held and accurately guided, and it will help if the tool is fitted with a handle of sufficient length to enable the upper end to be supported against the shoulder or the side of the chest. The above description deals with only one way of forming a single geometrical figure, but there are other methods in common use ; for example, a crescent can be cut by moving the scraper in a straight line and, at the same time, rocking the blade first to one side and then to the other. Again, two crescents can be formed simultaneously if a gap is ground in the cutting edge corresponding in width to the distance apart of the two figures ; this should at least ensure that the two halves of the paired markings are in line and are equally spaced.

Workshop Facilities at Wolverhampton

Mr. R. Jackson, 12, Ridge Street, Wollaston, Stourbridge, Worcs, has written to say that he thinks readers in the Dudley and Wolverhampton area may like to know that there is a very well equipped workshop available at Robert Street Evening Institute, Lower Gornal. Equipment includes a new 4½-in. Harrison lathe and milling attachment, a 12-in. stroke Ormerod high-speed shaper, a Pacera bench drilling machine and a large pillar drilling machine, besides a good variety of the usual metal-working tools. Every facility is available for brazing and forge work. This should be of interest to readers in that locality who may have only limited workshop resources, or who may occasionally have a job which is too big for their equipment. We understand that instruction and help are readily available, but will not be forced upon those who do not require them.

Mr. Jackson suggests that this institute might well become a sort of headquarters for model engineers in the district, and he is willing to provide information as to times, transport, etc., to anyone who writes to him at the address given.

The Model Car Association News

THE annual general meeting of the Association was held at Derby on February 24th, and was quite well attended, thirteen clubs being represented.

The chairman opened the meeting by requesting that the minutes of the last A.G.M. be read by the hon. secretary and treasurer. This was done, and the minutes passed, there being no questions arising from them. The chairman then made his report on the past year, saying that he felt that as far as the competition side was concerned, it had been a very good year, many open events having been supported even better than previously. The regional and national events had been very successful. He then thanked the retiring hon. secretary for his services, mentioning that he had taken on the duties in the early days of the Association, and served very ably through that difficult period. The chairman then ended his report by again stressing the fact that the clubs are the Association, and the strength or otherwise of the Association is in their own hands.

The officers of the Association then retired, and the election of new officers for 1952 took place. The chairman and hon. secretary and treasurer intimated that they did not wish to stand for re-election.

Officers were elected as follows :—

Chairman, Mr. J. C. Cook ; Vice-Chairman, Mr. C. M. Catchpole ; Hon. Secretary and Treasurer, Mr. I. W. Moore ; Hon. Records Officer, Mr. K. Procter ; Hon. Auditors, Messrs. Arthur-Brand and Zere.

The new officers then took office and several more items of business were raised. These were :—

(1) The definition of a " member " for the purpose of Rule 1.4 of the Constitution was requested by the treasurer. It was decided that the following should be inserted :

> " The Association shall receive from each club (or model car section of a model engineering club, as defined in Rule 1.3) the sum of 1s. 6d. per full member, irrespective of whether he is an active member, subject to the minimum of 10s. 6d. as laid down in Rule 1.4."

(2) Details of the National Speed Trophy were then decided as follows :—

The regional eliminations shall be held on July 6th at : South East, Edmonton ; South West, Bristol (if agreeable) ; Midland, Nottingham ; North West, Blackpool ; North East, Guiseley (Ossett, if Guiseley is not ready) ; Scotland, hon. secretary to contact Scottish clubs.

The National Finals to be held on July 27th at Nottingham, subject to the track being judged suitable. Cleethorpes agreed to accept the Finals if it should be found that Nottingham could not be used. (A committee of five was elected to decide at the Derby and Nottingham Open days whether Nottingham was suitable, but due to a rearrangement of open dates, which took place later in the meeting, this will not be possible, but a check will be made at about the middle of June, and a further report issued finalising the venue.)

It was agreed that rules should be generally as last year, the distance to be ¼ mile. Arrangements will be made for cars getting through to the finals to be run by proxy. It is hoped to supply clubs with a detailed set of rules later.

(3) Open dates were then discussed and considerable rearrangement from previous years had to be done, due to the awkward dates on which public holidays fall. The final dates are :—

May 11th, Edmonton ; May 25th, Guiseley ; June 2nd, Sunderland ; June 8th, Ossett ; June 29th, Cleethorpes ; July 6th, Regionals ; July 27th, Finals ; August 3rd, Cleethorpes ; August 17th, Blackpool ; August 24th, Surrey ; August 31st, Derby and Nottingham (at Nottingham). (Including Percival Marshall Trophy) ; September 14th, Guiseley ; September 21st, Pioneer.

(4) A query was raised as to why the certificates to be used as prizes (which it had been agreed should be procured by the Association), had not materialised, and it was explained that difficulty of supply at reasonable cost had been the trouble. A member now offered to endeavour to get them done, and the hon. secretary was instructed to draft out a suggested design.

(5) Discussion then took place on the conditions under which M.C.A. open days were to be run during 1952, and the following proposition was put and accepted.

> " Clubs shall be allowed to run open days by any system they desire, provided that details of the type of event be published at least six weeks before the event, and that such events comply with the General Racing and Constructional Rules of the Association."

This, in effect, allows clubs running open days to run Grading (using whatever grades they desire), British and Open, any of the systems suggested in the Press or of their own devising. They *must*, however, make sure that all clubs and the Association have full details at least six weeks beforehand. There must be no possibility of entrants travelling long distances, only to find that the rules or type of race was not as expected. It was pointed out, in reply to a query, that whilst this would allow clubs to try out new ideas, that they would be ill-advised to be too revolutionary, or their entries would probably suffer in consequence.

(6) The maximum weight limit for 1½ Class cars was reduced to 2 lb. (from 3 lb.).

(7) The question of subscriptions was then raised, and it was decided that in future all subscriptions should be brought to a common date, i.e. should run from June 1st to May 31st, and not from the time the club affiliated.

(8) It was agreed that the " gentlemen's agreement " (whereby the more experienced enthusiasts had agreed not to enter 1½ c.c. events, in an effort to encourage the younger and more impecunious members) should be ended, since it was considered that it would probably help if someone was to " show the way." So now it's up to everybody to " have a bash."

Hon. Secretary and Treasurer : I. W. MOORE, 2, Bridge Street, Derby.

A 12-BORE SIGNAL GUN

by H. J. Turpin

IN the issue of THE MODEL ENGINEER for February 14th, Mr. K. N. Harris asked for information concerning signal guns. The general outline of such a gun is usually that of a muzzle-loading piece of artillery of the Napoleonic period in which the barrel, with trunnions, was mounted on a carriage having two wheels and a heavy trail. Such details can readily be obtained from history books.

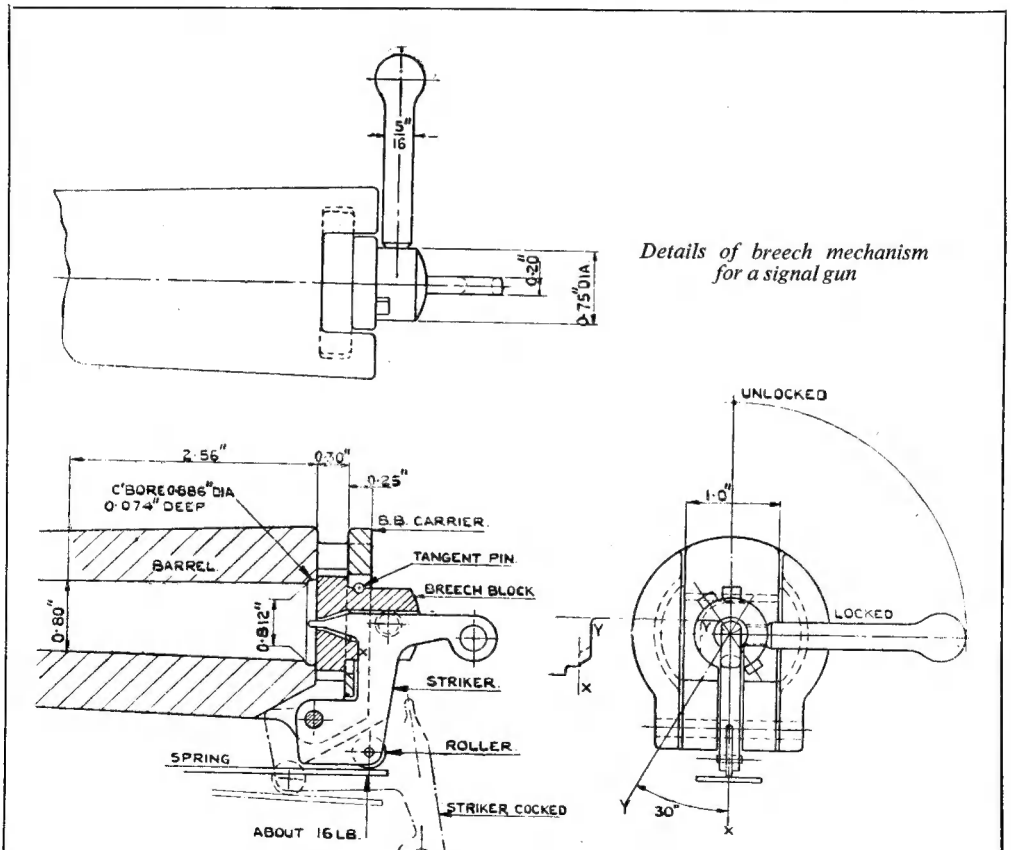
The breech mechanism for a signal gun is a different story, because, like all other gun actions, for safety reasons at all events both in opening and closing of necessity must take place in prescribed order, and no other. That is what causes apparent complication.

A breech action for Mr. Harris's problem is one of the simplest and is illustrated in the accompanying drawing. It is assumed that 12-bore blank cartridges (the usual) will be used and the chamber dimensions for this are given. It is assumed also that the gun will always be in careful hands, as readers must realise that this gun is not a toy, but can be a lethal weapon. For its purpose, however, it is perfectly safe and the action quite orthodox.

Into the rear of the barrel are cut resistance shoulders in the form of a recess 1.45 in. diameter and 0.30 in. wide and a vertical gap 1.03 in. wide cut to receive the locking mechanism.

The drawing shows the mechanism closed and fired. On opening the breech by the handle, the breech-block is rotated through 90 deg., but in the first 30 deg. of this rotation, and before the locking lugs are disengaged, the striker is retracted about 0.10 in., that is from plane *X* to plane *Y* by a 1-in. pitch cam on the breech-block.

When the handle is in the upright position, the whole unit swings down about a horizontal



Details of breech mechanism for a signal gun

axis pin passing through the barrel. The striker, of course, should be cocked before opening the breech, but the above action ensures safety, should that be forgotten. Ejection of the empty case is by a wood rod poked down the bore from the muzzle.

After inserting a live cartridge, the breech unit is raised into the gap in the barrel and the breech-block rotated into the resistance shoulders. It will be seen that, because of the two different levels produced by the cam, the striker cannot be permitted to protrude until plane *X* is in the position shown on the drawing.

The striker is fitted with a free-running roller at the bottom and is acted upon by a flat, lively spring, probably five inches long, as this has to produce a smart snappy action to fire the cap. A lanyard six feet long is used to fire the gun.

Signal guns are nearly always used aboard ship or somewhere on the coast, and because of this it is vital that they be protected both from the effects of salt spray and the corrosive effects of the propellant. In other words, they should be cared for as if they were a personal weapon.

And now for materials :—

Barrel—M.S. or cast-iron (the bore is unimportant, as no projectile is used).
Breech block—M.S. or malleable cast.
Breech block carrier—M.S. c'hardened.
Striker—M.S. c'hardened.
Roller—M.S. c'hardened.

Warning.—Cultivate a respect for a 12-bore blank cartridge as much as you do for your own life.

PRACTICAL LETTERS

Lancashire Mill Engines

DEAR SIR—For many years I have had ambitions to build a model Lancashire mill engine. Unfortunately, sufficient leisure time enabling me to achieve my ambition has not been forthcoming up to the present. However, I am still hoping. My engine would be somewhat similar to the one described by Mr. E. Bowness in THE MODEL ENGINEER, January 31st, 1952. The main difference would be that I should build a spun flywheel and pinion, with a short second motion shaft. Later would probably be added a section of upright shaft complete with bevel wheels and footstep bearings at the bottom. The reason for my preference is that the above type of power transmission is now almost extinct in Lancashire. There are still a goodly number of " rope drive " engines working in the various cotton towns and in my opinion these engines will continue working for many years to come, by reason of their low running costs alone. To anyone contemplating the building of a mill engine, my advice is build the flywheel first, as was done in full-size practice on installation. Either a spin wheel or rope wheel would prove a very interesting and fascinating job. All these wheels, including all driven and driving wheels, both in spin drivings and rope drivings, be it noted, are " staked " wheels. While smaller wheels may be cast in halves, flywheels are definitely built up in segments and all are staked to their shafts. A flywheel usually has ten keys fitted between boss and crankshaft, and ten arms fitted in their respective taper sockets in the boss. Arms are held in position by gibs and cotters. The rim is in ten segments and is bolted to the arm ends, plus steel floats fitted and driven in between the sides of the arm ends, and the " lips " and " rings " cast on the underside of the rim segments. In a cotton mill where a large number of ropes are used for drivings, as described by Mr. Bowness, there are usually two complete flywheels fitted close to each other on account of the width of rim necessary.

Both on visiting model engineering exhibitions and from photographs of model engines I have seen, no matter how excellent the workmanship has been, I have always felt keen disappointment to notice that flywheels have not been correct to prototype. Invariably, all the wheels have had their respective bosses bored to the crankshaft diameter and held in position by one key. I am an *ex*-millwright, and on seeing model wheels as above, I have shuddered in thinking of the sweat and toil that would have been necessary in removing a crankshaft from its boss, had the prototypes been built in a similar manner—especially beam engines which usually worked in confined spaces.

To anyone building a model Lancashire mill engine, although my spare time is scarce, I extend an offer of help in the design of a flywheel of correct pattern, and to anyone living within a reasonable distance of Oldham, I will undertake to stake and key the wheel or wheels for them if necessary.

Yours faithfully,
Oldham. WILLIAM BARLOW.

" Wagon-spring " Clocks

DEAR SIR,—As I happen to be an antiquarian as well as a model engineer—perhaps an unusual mixture—I venture to write to you regarding the clock on the front cover of the February 7th issue.

In Volume II of the *Furniture Treasury*, the latest standard work on old American furniture, there are three illustrations of similar clocks driven by what are referred to as " wagon " springs.

These were made by Birge & Fuller, of Bristol, Connecticut, in the 1830's. This firm proudly advertised their clocks as having " Improved Steel Springs." The method seems to lend itself to amateur construction, but mechanically there appears to be no reason to subject the wooden case to such stress. If the " works " were supported on the saddle of the wagon spring by vertical bars and the levers pivoted on these verticals, pointing outwards, the entire mechanism could be self-supporting.

Yours faithfully,
London, S.W.3. H. JOHNSTONE PRATT.

Dividing Appliances

DEAR SIR,—In the article of January 10th on a dividing head, you have taken my memory back to a curious dividing job which was given me by the late Col. Crompton, the well-known scientist and inventor.

About 1910 I was doing some machine work which had to be discussed with Col. Crompton, and on several occasions I was taken to the Colonel's laboratory at the top of his house, a very interesting place indeed. At that time he was engaged on cutting some very accurate screw gauges. He had a large bench micrometer of his own make, and as far as I can remember it was about the last word in measuring instruments of that day.

One morning he handed me a backplate of light pattern which he had screwed and fitted to the thimble end of his micrometer, and told me he wanted an index fitted of 647 divisions, or something like that, and I was to let him have it by tomorrow night.

I had previously told him that my partners and I had just bought a new miller and a first-class dividing head, but 647 divisions were quite impossible.

His reply was, "Which way are you going back to your works, Euston Road or Holborn? It does not matter much which way you go, on either route you can call at Messrs XX or YY and buy a good quality steel tape with metric divisions on it. When you get back to your works cut off 647 mm. and sweat the ends together on a piece of brass foil; mount a wood faceplate on your cast-iron one, and turn the rim to suit the tape; a spot of shellac, and that is all that is required." The job was done and delivered in about 36 hours.

Some of Col. Crompton's methods for cutting accurate threads, etc., were very interesting and I feel it was a great privilege to have had them shown me.

Yours faithfully,

Winscombe. J. W. TRACY.

Electronic Organs

DEAR SIR,—Your correspondent who so lightheartedly announces that he is going to build an electronic organ should be warned that the snags and problems involved are more serious than he might suppose. To start with, a musical note is not really a single note at all, but a combination of a basic note with a large number of harmonics, the proportions of which govern the nature of the sound produced. There are three main types of electronic organ :—

(1) The tuned-circuit type, in which each note is generated by an oscillating circuit tuned to the required frequency. It is fairly easy to design a circuit to give one note together with its harmonics, but the fun starts when a number of notes are played at once and fed into the same amplifier. The result is liable to be more interesting than musical. Several valves are needed for each note, not to mention a vast number of resistances and capacitors, so this type would be somewhat costly to build.

(2) The revolving-disc type which consists of a number of round glass plates on which the notes are reproduced—usually photographically. There are generally twelve discs—one for each note—and each disc has all the octaves of its own particular note in several different tones recorded in the form of circular sound tracks. They are played by beams of light shining through the discs on to photo-electric cells, the light being controlled from the keyboard by magnetically operated shutters. A variant of this type has twelve discs which are identical but driven at different speeds to give the correct notes. The Compton electronic organ now used by the B.B.C. is made on this principle.

(3) The vibrating-reed type, in which the note is produced by a metal reed kept vibrating either electrically or by the good old-fashioned method of blowing air through it. Underneath each reed is a magnet wound with a coil of fine wire. The vibrating reed sets up fluctuations in the magnetic field, thus generating small currents in the coil which are then amplified. Another way is to mount a rigid metal bar close to each reed, the bar and the reed acting as the two plates of a capacitor, which varies in value as the reed moves back and forth. This is probably the simplest type to make, and I would suggest that Mr. Siddons starts by looking round for a second-hand harmonium and experimenting with its innards. These contraptions contain a complete set of reeds and can often be bought very cheaply.

After all, if the worst came to the worst and he bankrupted himself buying valves and magnets, he could always earn an honest copper or two with it at the kerbside!

Yours faithfully,

London, S.W.9. MICHAEL OXLEY.

Painting Models

DEAR SIR,—I have frequently felt that painting is a subject I should know more about, and Mr. Austen-Walton's article in your February 21st issue on this subject with a dissertation on paints is interesting. The problem of keeping dust away has given him his fair share of trouble and judging from the finishes of most exhibition entries he is not alone. A clean oven should help here.

Perhaps the author of the article could say from what text-book he drew his information. The employment of turpentine as a drying agent is unusual, and in any case, its use goes back to pre-1939, whereas the word excipient belongs to the previous century. The word vehicle might be confusing.

With deference I should say that if a drying agent is "much in evidence" then therein may lie the cause of the trouble, as the detection of the metal concerned is usually left to a skilled analyst.

In these times, most metal finishers use primers. The coat of varnish is the nearest the article gets to this, though unorthodox. As primers may be mentioned later, I must leave the problem with the rightful author, but their use should be of interest in connection with brass.

Yours faithfully,

Albrighton. P. F. MANDER.